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Synanthedon loranthi (Lepidoptera: Sesiidae), een nieuwe wespvlindersoort voor België

Theo Garrevoet

Samenvatting. In maart 2019 werd in het zuiden van de provincie Luxembourg een aantal gezwellen veroorzaakt door maretak (*Viscum album*) ingezameld om een eventuele aanwezigheid van *Synanthedon loranthi* (Králícek, 1966) aan te tonen. Zowel gezwellen op appel (*Malus domestica*) als op eenstijlige meidoorn (*Crataegus monogyna*) werden meegenomen. Na enkele dagen was op enkele gezwellen daadwerkelijk frass zichtbaar en eind maart kwam een exemplaar uit van *S. loranthi* waardoor deze soort kan worden toegevoegd aan de lijst van wespvlinders van de Belgische fauna. Vervolgonderzoek leidde tot nog een paar extra exemplaren van verschillende locaties. De levenswijze van de soort wordt hier besproken alsook de momenteel gekende verspreiding in België en een waargenomen parasiet. Het feit dat de auteur rond de eeuwwisseling veelvuldig, maar vruchteloos, op geschikte terreinen in dezelfde streek gezocht heeft naar deze wespvlinder duidt er wellicht op dat deze soort in een recent verleden zijn areaal heeft uitgebreid.

Abstract. In March 2019, a number of swellings caused by mistletoe (*Viscum album*) were collected in the south of the Province of Luxembourg to demonstrate a possible presence of *Synanthedon loranthi* (Králícek, 1966). Both on apple (*Malus domestica*) and hawthorn (*Crataegus monogyna*) some galls were collected. After a few days, frass was visible on a few of these, and at the end of March a specimen of *S. loranthi* hatched, which means that this species can be added to the list of clearwings of the Belgian fauna. Follow-up research led to a few extra specimens from different locations. The bionomics of the species is discussed here, as well as the currently known distribution in Belgium and an observed parasite. The fact that, around the turn of the century, the author searched frequently, but in vain, for this clearwing species in suitable areas in the same region suggests that this species has expanded its area in a recent past.

Résumé. En mars 2019, un certain nombre de galles causées par le gui (*Viscum album*) ont été recueillies dans le sud de la province de Luxembourg pour démontrer la présence possible de *Synanthedon loranthi* (Králícek, 1966). Des galles ont également été collectées sur du pommier (*Malus domestica*) et sur de l'aubépine (*Crataegus monogyna*). Après quelques jours, de la vermoulure était visible sur quelques-unes de ces galles et, fin mars, un spécimen de *S. loranthi* a éclos, ce qui signifie que cette espèce peut être ajoutée à la liste des sésies de la faune belge. Des recherches ultérieures ont conduit à quelques spécimens supplémentaires provenant de différents endroits. La bionomie de l'espèce est discutée ici ainsi que la distribution actuellement connue en Belgique et la présence d'un parasite. Le fait que, vers le début de ce siècle, l'auteur ait recherché fréquemment, mais en vain, cette espèce de Sesiidae dans des zones appropriées de la même région laisse penser qu'il s'agisse d'une espèce qui a élargi son aire de répartition dans un passé récent.

Key words: Belgium – Faunistics – First record – La Gaume – Parasite – Wespvlinder.

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Inleiding

Aangezien er de laatste jaren een aantal Sesiidae als nieuw voor België gemeld zijn die vroeger, rond de eeuwwisseling, ondanks doorgedreven zoekacties niet werden waargenomen, leek het de auteur opportuun om een hernieuwde poging te ondernemen om *Synanthedon loranthi* (Králícek, 1966) te ontdekken. Hiertoe werd van een appelboom in een oude verwaarloosde boomgaard een gezwel, veroorzaakt door maretak (*Viscum album*) afgezaagd. Dit gezwel bevond zich relatief hoog in de boom en was zodanig gepositioneerd dat het veel zonlicht en –warmte ontving.

Verspreiding

Synanthedon loranthi komt voor in Centraal-, West- en Zuid-Europa (Laštůvka 2001) maar steeds lokaal. Wellicht speelt de onvoldoende kennis van de werkelijke verspreiding van deze soort een rol in het huidige beeld van geïsoleerde populaties (Špatenka *et al.* 1999, Bąkowski 2013). De soort was wel al bekend uit het Groothertogdom Luxemburg (Cungs 1998) en was dus een potentiële kandidaat om ook in België voor te komen. De landstreek "La Gaume" is dan, door het plaatselijke microklimaat en de nabijheid van het Groothertogdom Luxemburg, de voor de hand liggende streek om de zoektocht aan te vatten. Reeds in de jaren '90 van vorige eeuw zocht de auteur naar deze soort in die streek maar, ondanks speurwerk in verscheidene biotopen, bleef het resultaat uit. Een hernieuwde zoektocht in de lente van 2019 resulteerde echter snel in een positief resultaat.

Na de ontdekking van de eerste exemplaren werd ook nog in een ander biotoop in de Gaume met succes naar de soort gezocht. Vervolgonderzoek is gewenst om de momentele verspreiding beter te kunnen evalueren.

Morfologie

S. loranthi is variabel van grootte (spanwijdte 15–22 mm) en heeft bruinzwarte voorvleugels met wat gele schubben langs de voorrand en een variabele hoeveelheid gele schubben tussen de aders van het apicale veld. Het buitenste glasveld (ETA) is vrij groot en bestaat uit 5 cellen. De antennen zijn zwart evenals de palpen die echter ventraal felgeel zijn. De gele pericephale haren vormen een duidelijk contrasterende halskraag. Ook de tegulae op het borststuk zijn duidelijk geel afgeboord. Het abdomen is zwart met vaak een violette schijn en heeft gele banden op de segmenten 2 en 4 en vaak ook nog een smalle band op segment 6. Bij het mannetje is er tevens nog een gele band op segment 7 en is de achterlijfsborstel zwart met in het midden duidelijk gele haarschubben terwijl bij het vrouwtje de achterlijfsborstel grotendeels

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opvallend geel is met zwarte haarschubben aan de zijkanten. Er is dus een duidelijk seksueel dimorfisme. (Figs. 1–4 en Figs. 10–11).

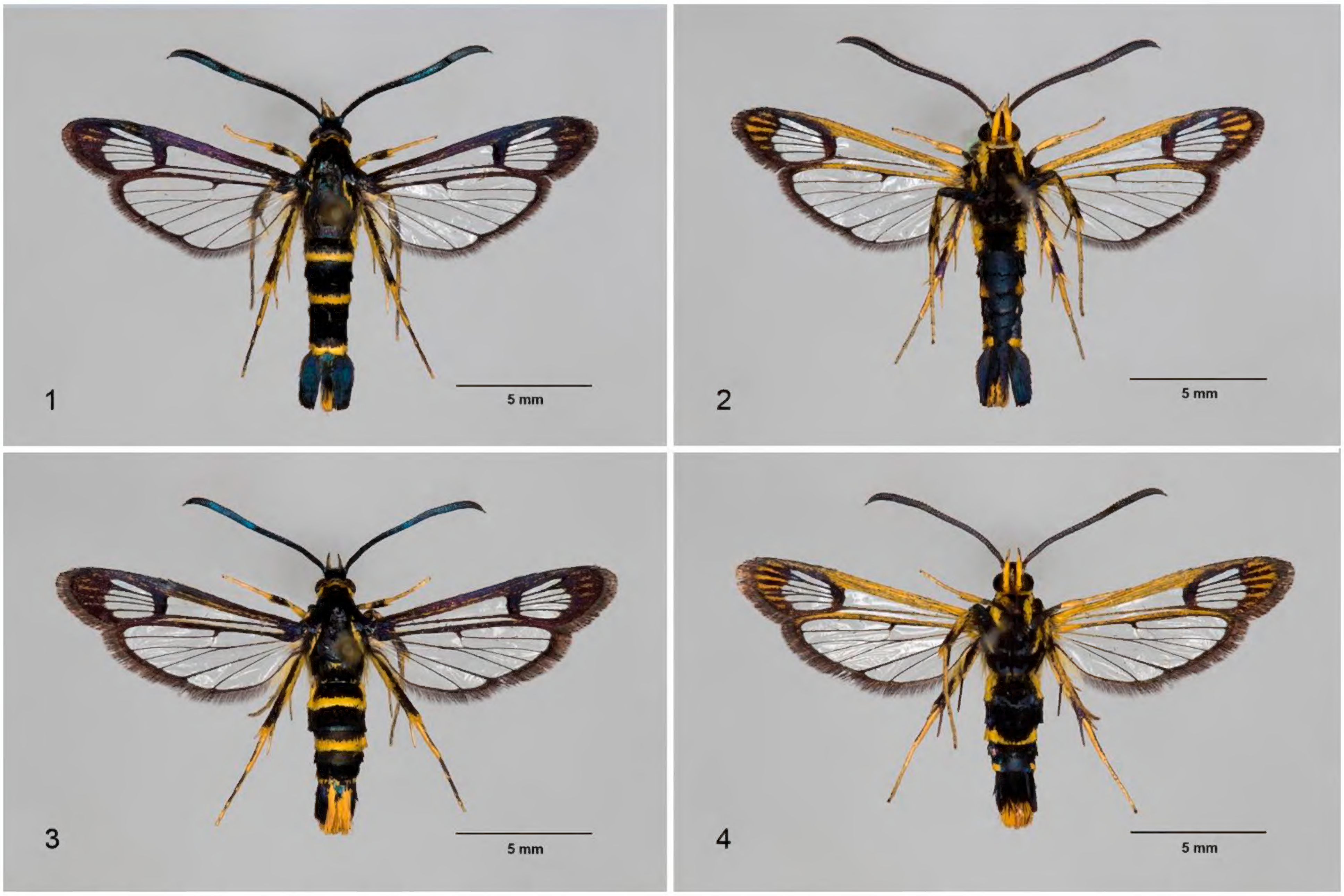
Synanthedon loranthi behoort tot een groep van vijf, qua externe morfologie, vrij gelijkaardig soorten waarbij, naast *S. loranthi*, ook nog *S. spuleri* (Fuchs, 1908) Spulers wespvlinder, *S. tipuliformis* (Clerck, 1759) bessenglasvlinder, *S. conopiformis* (Esper, [1782]) oranjetip-eikenwespvlinder en *S. cephiformis* (Ochsenheimer, 1808) behoren.

Zeker verse exemplaren van de imago's kunnen op basis van een aantal kenmerken meestal toch van elkaar onderscheiden worden. Voor *S. spuleri* is het opvallendste kenmerk dat de punt van de voorvleugel (apicale veld) zwart is met hoogstens enkele geel-oranje schubben tussen de aders en de zwarte achterlijfsborstel (anal tuft) die enkel aan de buikzijde soms wat gele haartjes bevat. Bij *S. tipuliformis* zijn de voorvleugelpunten tussen de aders zeer duidelijk oranje beschubd en is de anal tuft volledig zwart. *S. conopiformis* is duidelijk herkenbaar door de vierkante gele vlek op de metathorax en de koperrode schubben tussen de aders in de voorvleugelpunt. *S. loranthi* lijkt het meest op *S. cephiformis* en is hiervan enkel te onderscheiden doordat bij *S. loranthi* twee derden van het laterale deel van de coxa van de voorpoten geel is terwijl dit deel bij *S. cephiformis* volledig geel is. De discoidale vlek op de achtervleugel is bij *S. loranthi* ook duidelijk kleiner dan bij *S. cephiformis.* Deze laatstgenoemde soort is echter in België nog niet vastgesteld en is ook niet zo direct te verwachten omdat de soort leeft in door een schimmel veroorzaakte gezwellen op gewone zilverspar (*Abies alba*) en deze naaldboom komt in België niet of nauwelijks voor.

Afgevlogen vlinders zijn vaak een stuk moeilijker op naam te brengen en genitaalonderzoek heeft hier weinig zin omdat eventuele verschillen te klein en niet constant zijn.

Biologie

Synanthedon loranthi heeft een vrij lange vliegperiode die van eind mei tot begin augustus loopt. De hoofdvliegtijd ligt van half juni tot eind juli. De waardplant van deze wespvlindersoort is de halfparasiet *Viscum album* (maretak) waarbij – zeer opvallend – *Viscum album* subsp. *austriacum* de voorkeur geniet. In meerdere landen wordt *S. loranthi* omzeggens uitsluitend op deze ondersoort van *Viscum album* L. aangetroffen (Ebert 1997, Schweizerischer Bund für Naturschutz 2000). Deze ondersoort groeit op *Pinus* spp. (den) maar komt in België niet voor. *Synanthedon loranthi* accepteert echter ook *Viscum album* subsp. *abietis* (Wiesb.) Abrom. op *Abies* spp. (zilverspar) en *V. album* subsp. *album* op andere gastheren zoals *Malus* spp. (appel), *Crataegus* spp. (meidoorn) en wellicht nog andere boomsoorten zoals *Populus* spp. (populier). Ook de tot een ander genus behorende maretak *Loranthus europaeus* Jacq., die op *Quercus* spp. (eik) groeit, wordt geïnfesteerd. *S. loranthi* werd overigens voor het eerst in deze maretaksoort waargenomen en ontleent er zijn naam aan.



Figs 1–4. *Synanthedon loranthi*, Chenois (LX), 14.iii.2019, ex larva, maatstreep/scale bar 5 mm, © Theo Garrevoet.

Fig 1. ♂ bovenzijde, imago uitgekomen on 17.v.2019

Fig 2. ♂ onderzijde, imago uitgekomen op 17.v.2019

Fig 3. ♀ bovenzijde, imago uitgekomen op 14.v.2019

Fig 4. ♀ onderzijde, imago uitgekomen op 14.v.2019

Het wijfje legt eitjes af aan de basis van maretak planten. Dit werd ook waargenomen op 18.vi.2019 op dezelfde lokaliteit te Chenois waar de auteur de meeste rupsen vond (pers. comm. Ruben Meert). Meestal worden goed zonbeschenen maretakken hoog in de gastheer geprefereerd. De jonge rups boort zich dan in de plant en leeft in de transitiezone van de maretak en diens gastheer tussen hout en bast in een korte gang en voedt zich daar met plantensap. De uitgestoten frass is meestal korrelig en rood-bruin maar soms is het gedeeltelijk veel lichter van kleur. Dit kleurverschil is wellicht te wijten aan de oorsprong van de frass: roodbruin als het van de waardplant afkomstig is –die bovendien dus ook nog eens verschillend kan zijn– en lichtgeel als het van de maretak afkomstig is (Fig. 5).

Fig 5. *Synanthedon loranthi*, Chenois (LX), 07.iv.2019, uitgestoten frass. © Theo Garrevoet.

Regelmatig wordt er immers ook een gang aangelegd in de maretak zelf. Later wordt de gang vaak uitgebreid naar een vlakke, dikwijls ovale mijn. In de winter en vroege lente is er meestal nog helemaal geen frass te zien. Vaak wordt het ook weggespoeld door regen of waait het weg door de wind. De uitkomstgang, met het uitwendig onzichtbare toekomstige uitkomstgat, wordt in de lente voorbereid en bevindt zich meestal aan de basis van de maretak in de overgangszone met het hout van de gastheer. Slechts uitzonderlijk wordt het in de basis van de maretak zelf aangelegd. De rups maakt een nogal rudimentaire cocon (Fig. 6).

Een paar dagen voor het imago uitkomt verkleurt de pop van geelbruin naar zwart. Bij het uitkomen breekt de pop eerst door het dunne membraan dat de gang nog afsluit en schuift, zoals bij alle Sesiidae, gedeeltelijk naar buiten. Het uitkomen zelf gaat, net als het ontvouwen en drogen van de vleugels, bijzonder snel. Meestal blijft het lege exuvium nog geruime tijd steken tot weer en wind of een andere externe oorzaak ervoor zorgt dat het exuvium ofwel afbreekt ofwel –uitzonderlijk– uit de uitkomstopening valt. (Fig. 7).

Fig 6. *Synanthedon loranthi*, geopende rudimentaire cocon. © Theo Garrevoet.

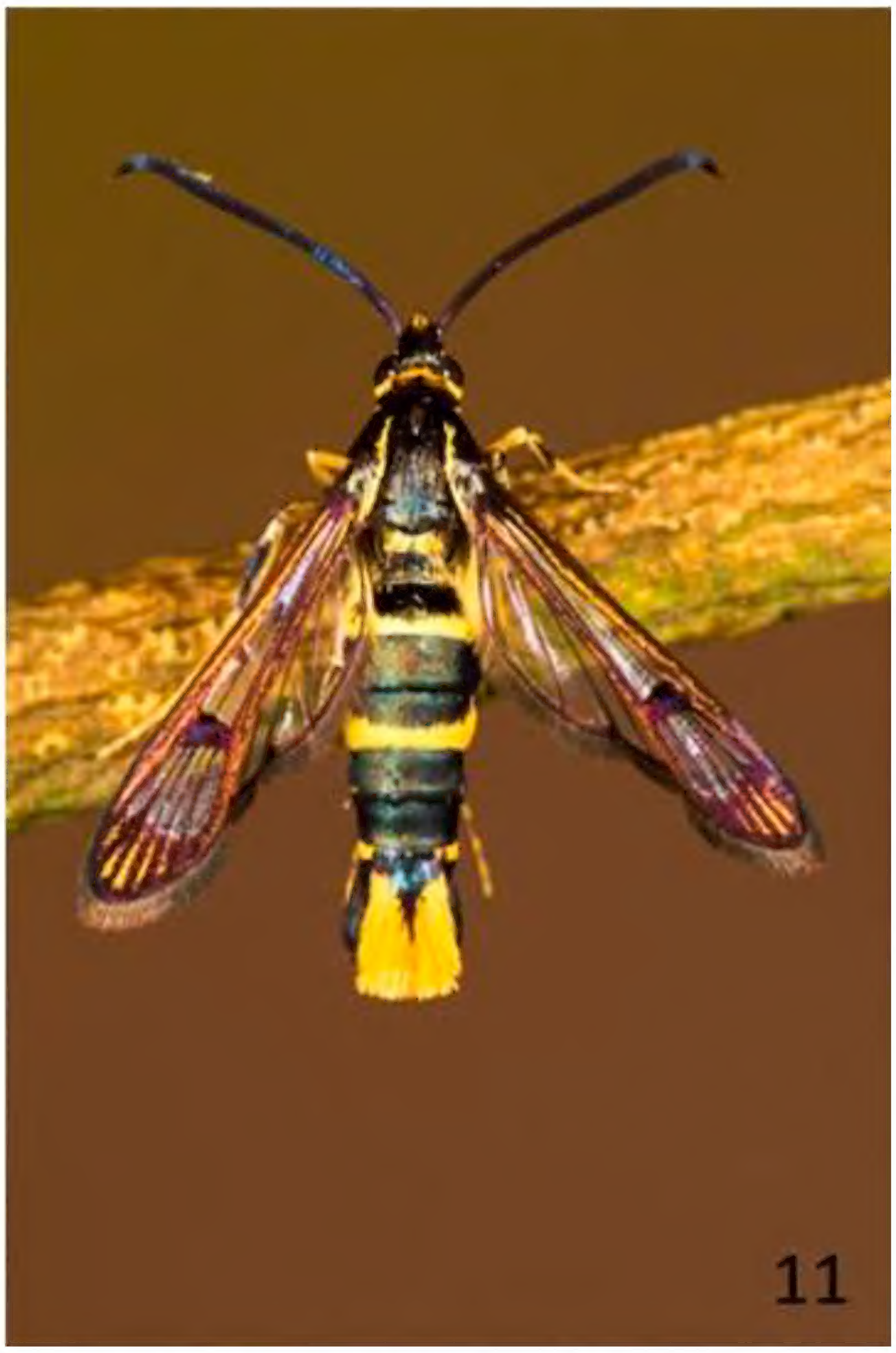
Fig 7. *Synanthedon loranthi*, Chenois (LX), 07.iv.2019, exuvium. © Theo Garrevoet.

De ontwikkelingscyclus van *S. loranthi* voltrekt zich in één jaar, eerder uitzonderlijk in twee jaar.

Meerdere literatuurbronnen vermelden ook dat de levenscyclus van *S. loranthi* zich overwegend in de boomkruinen afspeelt (Ebert 1997, Schweizerischer Bund für Naturschutz 2000). Slechts een enkele keer wordt er een imago waargenomen bij bloembezoek waarbij *Ligustrum* spp. (liguster) en *Sambucus ebulus* (kruidvlier) blijkbaar geprefereerd worden. Een effectief artificieel feromoon is nog niet beschikbaar en de respons van de mannetjes op testferomonen is nogal pover. Het valt ook op dat feromoonvallen die tot in de boomtoppen worden gehesen desondanks effectiever zijn dan valletjes die op lagere hoogte worden opgehangen (Ebert 1997).

Er werden ook twee exemplaren van een parasitaire sluipwesp uitgekweekt die allebei tot dezelfde soort behoren: *Liotryphon crassiseta* (Thomson, 1877) (Hymenoptera: Ichneumonidae: Pimplinae). Dit is een vrij veel voorkomende en regelmatige parasiet van Sesiidae in twijgen, onder schors, enz. (pers. comm. Mark Shaw) (Fig. 8).

Blijkbaar gaat het toch om een tot nog toe weinig waargenomen soort in België want in waarnemingen.be is er geen enkele melding terug te vinden. In het KBIN is slechts één exemplaar bekend: 1 ♀ Arlon (LX), 12.v.1870, coll. Dr. J. Tosquinet, det. Pierre-Nicolas Libert. Nochtans is *L. crassiseta* bekend van een twintigtal lokaliteiten (pers. comm. Pierre-Nicolas Libert). Deze sluipwespen komen op dezelfde plaatsen uit de waardplant tevoorschijn als de wespvlinder zelf. Het uitkomstgat is echter scherp afgelijnd en er is ook geen exuvium dat eruit steekt (Fig. 9).



Figs 8–9. *Liotryphon crassiseta.* Fig 8. Ex larva, imago uitgekomen op 14.iii.2019. Fig. 9. Uitkomstgat van de sluipwesp afgebeeld in Fig 8.
Figs 10–11. *Synanthedon loranthi.* Fig 10. Ex larva, Chenois (LX), 14.iii.2019, ♂ imago op 17.v.2019. Fig 11. Ex larva, Torgny (LX), 24.iii.2019, ♀ imago op 17.iv.2019. © Theo Garrevoet.

Conclusies

Synanthedon loranthi is een nieuwe soort voor de wespvlinderfauna van België. Als Nederlandse naam wordt er, verwijzend naar de waardplant, geopteerd voor maretakwespvlinder. Appel en eenstijlige meidoorn zijn momenteel in België de enige gastheerplanten van maretak waaruit imago's van deze wespvlinder gekweekt zijn. De vrouwtjes hebben bij het afleggen van de eitjes een voorkeur voor zonbeschenen maretakplanten hoog in de boom.

Beide geslachten vertoeven graag in de boomtoppen en komen enkel omlaag om nectar te zuigen. De respons op feromonen is beperkt.

Predatie door een voor Sesiidae typische sluipwesp *Liotryphon crassiseta* (Thomson, 1877) werd vastgesteld tijdens de kweek.

Omdat er in de laatste decade van vorige eeuw intensief – maar zonder succes – naar deze soort werd gezocht, ook op gelijkaardige locaties in de omgeving waar de soort nu werd aangetroffen, mag men redelijkerwijs aannemen dat *S. loranthi* in de tussenliggende periode een areaaluitbreiding heeft gekend.

Dankwoord

De auteur dankt Ruben Meert voor de melding van het eileggend vrouwtje van *S. loranthi*. L'auteur remercie également Jean-Luc Renneson pour l'admission qui a permis de mener des recherches dans la "Réserve Raymond Mayné" à Torgny (LX).

Mark Shaw is thanked for the identification and additional information on the bred Ichneumonidae parasite species. Stefan Kerkhof (KBIN) wordt bedankt voor het nakijken of er exemplaren aanwezig waren van *Liotryphon crassiseta* in het KBIN. Pierre-Nicolas Libert est remercié pour les informations supplémentaires sur la présence de *L. crassiseta* en Belgique.

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Review of the genus *Phylloecus* (Hymenoptera: Cephidae) in Belgium and Western Europe

Fons Verheyde & Ruben Meert

Abstract. Based on existing literature, data from citizen science portals and new findings in the field, the genus *Phylloecus* Newman, 1838 (= *Hartigia* Schiødte, 1839) is reviewed. Apart from details of the local distribution in Belgium, other aspects are investigated more extensively. The reproduction mechanisms of *P. faunus* are discussed: it seems to be parthenogenetic in the northern parts of Europe (1). We confirm the morphological diversification of the *P. niger* species complex living on *Rosa* spp. (2). Having found and reared *Phylloecus linearis* and *P. xanthostoma*, new illustrative material is provided of both larvae and their ecology (3). A morphological table compares the similarities and differences between the four species currently known in Western Europe (4).

Samenvatting. Op basis van de bestaande literatuur, data uit portalen als Waarnemingen.be en nieuwe vondsten in het veld, wordt het genus *Phylloecus* Newman, 1838 (=*Hartigia* Schiødte, 1839) herbekeken. Naast de lokale verspreiding in België worden ook meer specifieke aspecten onderzocht. De (a)seksuele voortplanting van *P. faunus* wordt bijvoorbeeld besproken, die parthenogenetisch blijkt te zijn in de meer noordelijke regio's van Europa (1). We bevestigen de morfologische diversificatie van *P. niger* op *Rosa* spp. (2) Door het vinden en uitkweken van larven van *Phylloecus linearis* en *Phylloecus xanthostoma* wordt nieuw beeldend materiaal getoond van de larven en hun ecologie (3). Tot slot moet een morfologische tabel de gelijkenissen en verschillen tussen de vier West-Europese soorten verduidelijken (4).

Résumé. Sur base de la littérature existante, de données provenant de différents portails d'encodage en ligne comme observations.be et de nouvelles découvertes de terrain, le genre *Phylloecus* Newman, 1838 (=*Hartigia* Schiødte, 1839) est revu. Mis à part les détails de la répartition pour la Belgique, des informations plus spécifiques sont fournies. La reproduction (a)sexuée de *P. faunus* est discutée; elle semble être parthénogénétique dans les zones les plus septentrionales de l'Europe (1). Nous confirmons la diversification morphologique de *P. niger* vivant sur *Rosa* spp. (2). Suite à la découverte et à l'élevage de larves de *Phylloecus linearis* et *P. xanthostoma*, de nouvelles illustrations sont fournies tant pour les larves que pour leur écologie (3). Finalement, un tableau comparatif met en évidence les ressemblances et les différences morphologiques entre les quatre espèces d'Europe de l'Ouest (4).

Key words: Ecology – Distribution – *Hartigia* – Larvae — Morphology — Sawfly — Stem-borers.

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Introduction

Stem-borers of the genus *Phylloecus* Newman, 1838 (= *Hartigia* Schiødte, 1839) belong to the family Cephidae, one of the smaller families of Symphyta, sawflies. At present, four species are known from Europe. The species are well described in literature (see esp. Jansen 1998). However, quite recently the genus was revised taxonomically by Liston & Prous (2014), who synonymised *Hartigia* and *Phylloecus*. Moreover, apart from some remarks in the studies by Wolf (1968) and Burggraaf-van Nierop & van Achterberg (1990), the situation in Belgium has never been studied in depth. Using citizen science portals (*in casu* www.waarnemingen.be) and literature, we are now able to receive new insights on distribution. We also want to introduce *P. faunus* (= *H. helleri*). This species has not yet been discovered in Belgium, but is very likely to be present, having been found already in France and The Netherlands (pers. comm. A. Mol).

Some aspects related to the sawflies' ecology are shared by all four species. The larvae feed within the stems of herbaceous plants. Distributional details are closely associated with the presence (or absence) of such plants. Cephids are univoltine, and adults are mainly active from May to June. Exceptionally, adults can be found in April (pers. comm. A. De Ketelaere 2020) or in the late summer (e.g. a specimen of *P. niger* was caught on 24 August; Magis 2007). Using phenological statistics from the compiled data (in particular, *P. niger*; see Diagramme 1), it is clear that males tend to emerge before the females.

At least 25% of the recorded specimens based on photographic evidence were feeding on the flowers of a variety of plants, including *Cornus* and *Euphorbia* spp., but generally seemed to favour umbellifers (Apiaceae), especially *Anthriscus sylvestris,* and more occasionally *Heracleum sphondylium* and *Daucus carota;* see Fig. 3a).

From the summer onwards, larvae can be found in the often withered stems of host plants. The final instar larva spins a cocoon at the end of its gallery, in which it hibernates (see also Fig. 5c). Pupation takes place only a few weeks before its emergence as an adult (Bruzzese 1982). The larvae are often parasitized, and a lot of cases have been reported (i.e. Bruzzese 1982 for *P. faunus*, De Jong 1964 for *P. niger*, etc.).

Phylloecus faunus Newman, 1838
Schijn-bramenstengelboorder
Morphology

Phylloecus faunus belongs to species-complex A (see Table I) and closely resembles the sister-species *P. niger*. However, it can be distinguished paying attention to certain details. Microscopic features are differences in the colouration of the mandibles (middle part whitish) and differences in punctuation of frons and prothorax (shiny). The clearest difference is that of the length of the vertex,

Table I. Morphology of Phylloecus spp. in Western Europe based on personal findings and Muche (1981), van Nierop & van Achterberg (1990), Jansen (1998) and Liston & Prous (2014).

Complex A	***P. faunus***	***P. niger***
Length	♀♀ 10–18 mm ♂♂ 11–15 mm	♀♀ 9–18 mm ♂♂ 9–17 mm
Antennal segments	♀♀ 24–28 (black) ♂♂ 26–27 (black) ♀♂ Proportion 3th to 4th antennal segment: 10: 8.6 (± 0.4)	♀♀ 22–29 (black/brown); see remarks ♂♂ 26–27 (black/brown); see remarks ♀♂ Proportion 3th to 4th antennal segment: 10: 7.8 (± 0.4)
Mandibles	♀♂ Middle part whitish	♀♀ Middle part dark brown ♂♂ Middle part yellow
Head	♀♂ Distance of vertex (ocelli – hind margin of the head) to the largest eye diameter 10: 13.5 dorsally ♂♂ Two yellow markings on clypeus, with a black spot in the middle	♀♂ Distance of vertex to the largest eye diameter 10: 10.4 dorsally ♂♂ Clypeus black or completely yellow
	♀♀ Sparsely punctuated, shiny ♂♂ Sparsely punctuated, very shiny	♀♀ Frons strongly punctuated but matt (c. clypeus) ♂♂ Frons punctuated
Thorax	♀♂ Black	♀♂ Black
	♀♂ Prothorax and pronotum shiny	♀♂ Prothorax and pronotum matt
Legs	♀♂ Coxae, trochanters and femora black	♀♂ Coxae, trochanters and femora black ♂♂ Posterior side of front legs yellow
	♀♀ Knees, tibiae and tarsi brownish-yellow to red-brown ♂♂ Knees, tibiae and tarsi red-brown	♀♀ Knees, tibiae and tarsi brownish-yellow ♂♂ Knees, tibiae and tarsi yellow
Abdomen	♀♀ Black, with limited amount of yellowish-white stains on T3–T6. Stain on T5 sometimes completely reduced ♂♂ Black, with ivory stains on the hind margins of T3–T7. Spot on T5 is very small (only the outermost corner is spotted), together with T6 sometimes greatly reduced	♀♂ Black, with broader (light) yellowish-white markings on T3, T4 and T6
Wing venation (these characteristics need further confirmation)	♀♂ Basal slightly dull, distal clear, other veins dark brown. Pterostigma dark brown, but brightened in the middle ♀♀ Costa bright brown ♂♂ Costa red-brown	♀♂ Basal and distal clear, other veins dark brown, costa yellow ♀♀ Pterostigma brownish-yellow ♂♂ Pterostigma dark brown

Complex B	*P. linearis*	*P. xanthostoma*
Length	♀♀ 10–18 mm ♂♂ 10–17 mm	♀♀ 10–17 mm ♂♂ 10–17 mm
Antennal segments	♀♀ 23–27 ♂♂ 24–27 ♀♂ Proportion 3th to 4th antennal segment: 10: 7.5 (± 0.3)	♀♀ 24–29 ♂♂ 22–26 ♀♂ Proportion 3th to 4th antennal segment: 10: 6.5 (± 0.4)
Mandibles	♀♀ Dots on the outer margin ♂♂ Dots can be found on several places, except for the browner tips	♀♀ Dots reaching outer margin ♂♂ Dots sometimes reaching mandibles, having browner tips
Head	♀♂ Black, with (large) yellow dots on clypeus ♂♂ Upper side of clypeus with one yellow spot, enclosing a triangular shaped black spot in the middle	♀♂ Black, occasionally with small yellow dots on clypeus ♂♂ Upper side of clypeus with one yellow spot, enclosing a triangular shaped black spot in the middle
	♀♂ Sparsely punctuated, very shiny; vertex behind ocelli arched	♀♀ Punctuated, very shiny ♂♂ Sparsely punctuated, very shiny ♀♂ Vertex behind ocelli flat
Thorax	♀♂ Black	♀♂ Black
	♀♂ Pronotum margins yellow ♀♀ At least yellow dots on scutellum	♀♂ Pronotum margins yellow
Legs	♀♂ Coxae, trochanters and femora black; fore and hind coxae with resp. little and larger yellow dot	♀♂ Coxae, trochanters and femora black; fore and hind coxae with resp. little and larger yellow dot
	♀♂ Knees, tibiae and tarsi yellow	♀♂ Knees, tibiae and tarsi yellow
Abdomen	♀♀ Black, with yellow stains on T2 and T5. Broader yellow markings on T3, T4, T6 and T7. Narrower on T8. T9 with one yellow spot in the middle of the tergite ♂♂ Black, with yellow stains on T2 and T5. Broader yellow markings on T3, T4, T6-T8. T9 with a narrower marking on the hind margin	♀♀ Black, with yellow markings on T3, T4, T6–T8 ♂♂ Black, with yellow stains on T2 and T5. Broader yellow markings on T3, T4, T6–T8. T9 with a narrower marking on the hind margin
Wing venation	♀♂ Wings slightly yellow, with veins brown. Pterostigma brown, but front margin somewhat brighter, costa yellow	♀♀ Costa (light) brown, wings slightly infuscate, pterostigma brown, but brightened in the middle ♂♂ Costa yellow, wings slightly yellow, pterostigma brown, but front margin somewhat brighter

the distance between the ocelli and the hind margin of the head, which is longer in *P. faunus*. For photographic facets, we have to distinguish between females and males, the latter in some populations being extremely rare (see Remarks under the debate about males). Although soft characteristics females generally appear to have yellowish-white stains (Fig. 1a) instead of broader stripes or markings on their abdomen in the case of *P. niger* (Fig. 3a). According to Jansen (1998) the posterior side of the front legs of *P. niger* is yellow, while it is black in *P. faunus*. Finally, in both sexes of *P. faunus*, the costa is stated to be bright reddish-brown, but yellow in *P. niger*; this feature needs further study because it has been shown to be difficult to use in several cases.

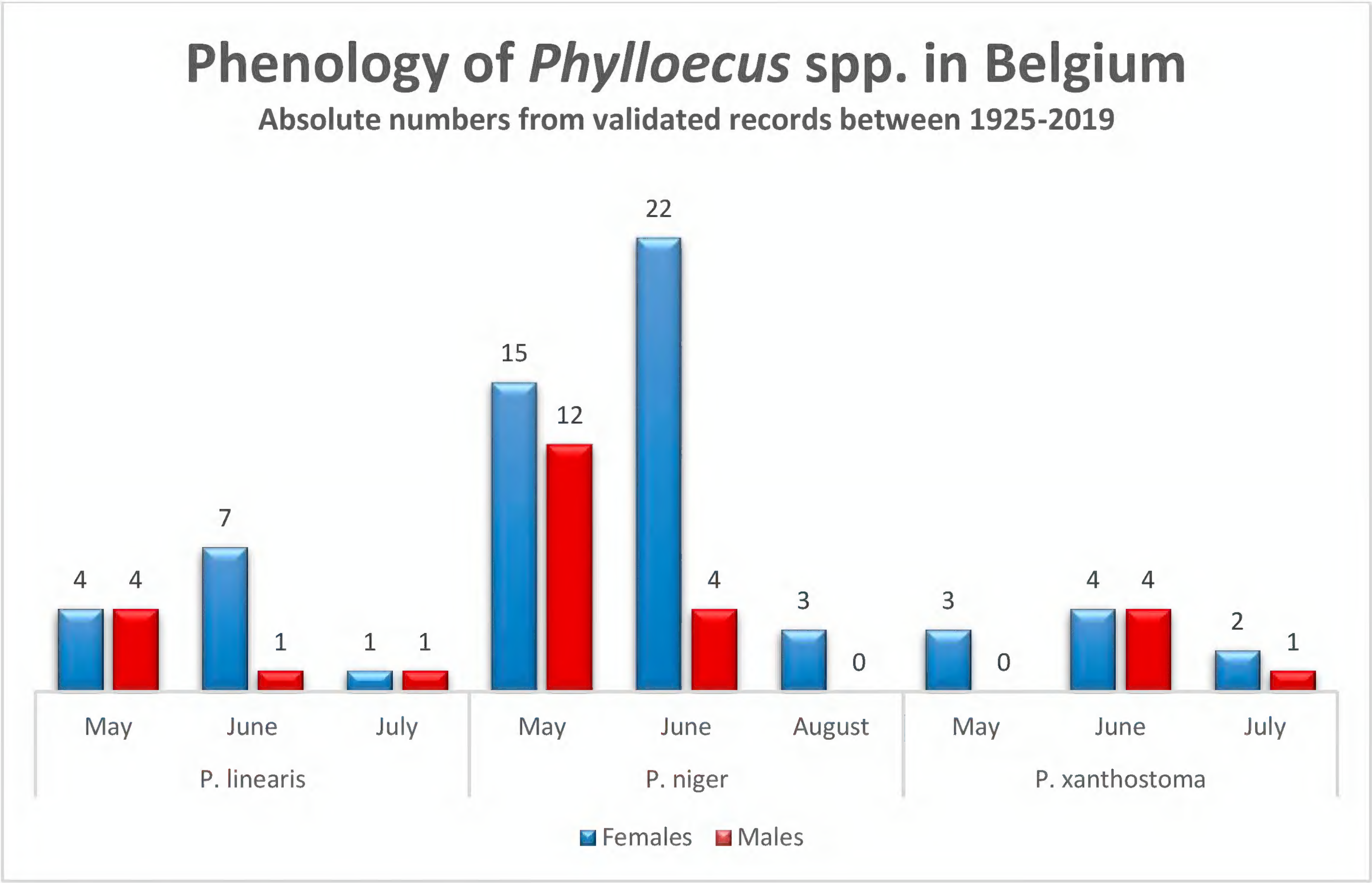

Diagramme 1. Phenology of *Phylloecus* spp. in Belgium.

Distribution

Liston & Prous (2014) synonymised *Phylloecus faunus* with *Hartigia helleri* Taschenberg, 1871, also known as *Hartigia albomaculata* (Stein, 1876). Closer to the Low Countries, it is known to occur in Austria, Italy, Spain, Switzerland, and in France, especially along the coast line (Chevin 1993; Jansen 1998; Chevin & Chevin 2007). Recently it was discovered in The Netherlands (pers. comm. A. Mol).

Remarks

The close relationship between *P. faunus* and *P. niger* has resulted in them being referred to as species-complex A. In contrast to the other species-complex, the differences in host material are minimal. Both *P. faunus* and *P. niger* are known to use *Rubus fruticosus* agg. as a host plant. Hence, 'Schijn-bramenstengelboorder' is proposed here as the Dutch vernacular name, respecting the historical name of the other species. According to Bruzzese (1982), who studied the species profoundly, only primocanes (vigorous first year canes) are used, although stems are usually biennial. Furthermore, it was stated to be common to find two or sometimes three groups of several larvae boring in different sections of the same primocane.

There is no real consensus at this moment about the sexual reproduction of the species. Reviewing literature, males seem to be (extremely) rare in Western Europe, with only a few reports by Chevin (1993) and Jansen (1998). Bruzzese (1982), having reared about thousand specimens, explicitly stated parthenogenetic reproduction. It is concluded that the incidence of sexual reproduction seems to differ depending on the locality. Specifically, sexual reproduction is highly probably in North-Africa, with gender-ratios sometimes reaching 50/50 (pers. comm. A. Liston) – closer to the Equator, while parthenogenetic reproduction is more typical in northern populations (see also Benson 1950).

Fig. 1a. *Phylloecus faunus* ♀, coll. Senckenberg Deutsches Entomologisches Institut (SDEI); Saint-Rémy-de-Provence, 10–19.vi.1989. © A. Liston.

Fig. 1b. *Phylloecus faunus* ♀, coll. Senckenberg Deutsches Entomologisches Institut (SDEI); South of France, 1978, ex *Rubus fruticosus*. © A. Liston.

Phylloecus linearis (Schrank, 1781) Agrimoniestengelboorder Reported specimens

1 ♂; Diest, VB; 29 Jul. 1932; Crèvecoeur & Maréchal 1933 • 3 ♀ 4 ♂; Sterrebeek, VB; 21 May 1936; Wolf 1968 • 1 ♀; Loën (Montagne St-Pierre), LG; 29 Jul. 1936; Wolf 1968 • 1 ♀; Destelbergen, OV; 20 Jun. 1941; Wolf 1968 • 1 ♀; Sint-Genesius-Rode, VB; 4 Jun. 1942; Wolf 1968 • 1 ♀; Hombourg, LG; 30 Jun. 1950; Wolf 1968 • 1 ♀; Gembloux, NA; 22 May 1965; Wolf 1968 • 1 ♀; Ciergnon, NA; 11 Jun. 1966; Wolf 1968 • 1 ♀; Rosport, LX; 17 Jun. 1977; Magis 2013; J. Petit leg.; on *Cornus sanguinea* • 1 ♂; Holzwarche, LG; 10 Jun. 1978; Magis 1980 • 1 ♀; Somal, NA; 13 Jun. 2010; Libert & Magis 2015; P-N. Libert leg. coll.; on *Heracleum sphondylium* • 1 ♀; Sart-en-Fagne, NA; 1 Apr. 2019; observations.be; R. Meert leg.; F. Verheyde coll.; reared ex *Agrimonia eupatoria* • 1 larva; Rochefort, NA; 20 Sept. 2019; observations.be; R. Meert leg.

Fig. 2a. *Phylloecus linearis* ♀, coll. F. Verheyde; leg. R. Meert, Belgium, Sart-en-Fagne 2019, ex *Agrimonia eupatoria*. © F. Verheyde.

Fig. 2b. *Phylloecus linearis* ♀, coll. F. Verheyde; leg. R. Meert, Belgium, Sart-en-Fagne 2019, ex *Agrimonia eupatoria*. © F. Verheyde.

Morphology

Belonging to species-complex B (see Table 1), *Phylloecus linearis* closely resembles *P. xanthostoma*. Females of *P. linearis* always have yellow dots on the scutellum (Figs. 2a-b.) and the yellow dots on the clypeus are rather large and more or less clear (Fig. 2c). Males are very hard to distinguish; apart from a small difference in the shape of the vertex behind the ocelli (Burggraaf-van Nierop & van Achterberg 1990) and the length of the fourth antennal segment, no clear differences are known. This is why '*Hartigia* spec.' on citizen science portals mostly contains males of the *Hartigia linearis/xanthostoma*-complex.

Fig. 2c. *Phylloecus linearis* ♀, coll. F. Verheyde; leg. R. Meert, Belgium, Sart-en-Fagne 2019, ex *Agrimonia eupatoria*. © F. Verheyde.

Distribution

Due to the relative rarity of the host plant *Agrimonia eupatoria*, in high densities, *P. linearis* will probably the rarest of the three reported species at present. Following the distribution of the host (and its density on some places), recent observations are mainly confined to calcareous localities in Wallonia.

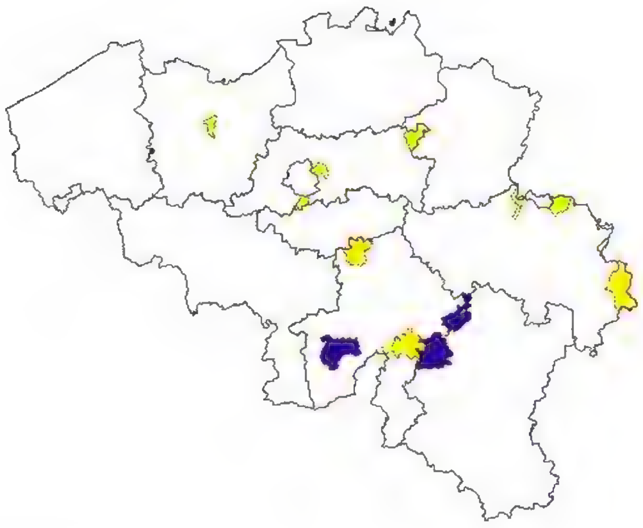

Fig. 2d. Distribution of *Phylloecus linearis* (purple = observations after 2000).

Remarks

In February 2019, one larva of *P. linearis* was found in an on older stem of *Agrimonia eupatoria* by the second author. The plant containing the *P. linearis* larva was found along a southwest facing forest edge in Sart-en-Fagne (Namur). The larval observations showed many similarities to those of *P. xanthostoma* (Fig. 6, see below). The larva was reared successfully in breeding conditions and emerged as a female, with minor damage to the wing structure.

Phylloecus niger (M. Harris, 1779) Bramenstengelboorder Reported specimens

• 1 ♂; Plainevaux, LG; 12 May 1925; Carpentier et al. 1925; P. Maréchal leg. coll. • 1 ♀ 1 ♂; Kinkempois, LG; 21 May 1926; Crèvecoeur & Maréchal 1927; P. Maréchal leg. coll. • 1 ♀; Loën, LG; 26 May 1931; Wolf 1968 • 2 ♀; Sterrebeek, VB; 6 Jun. 1937; Wolf 1968 • 1 ♀; Everberg, VB; 9 Jun. 1942; Wolf 1968 • 2 ♂; Loën (Montagne St-Pierre), LG; 28 May 1949; Wolf 1968 • 1 ♀; Everberg, VB; 4 Jun. 1951; Wolf 1968 • 1 ♂; Rochefort, NA; 17 Jun. 1951; Magis 2007; P. Maréchal leg. coll. • 2 ♀; Ukkel, BR; 3 Aug. 1951; Wolf 1968 • 1 ♀; Han-sur-Lesse (Thier de la Chapelle), NA; 14 Jun. 1955; Magis 2007 • 1 ♀; Hombourg, LG; 21 Jun. 1955; Wolf 1968 • 1 ♂; Eben-Emael, LG; 14 May 1959; Magis 2007; P. Maréchal leg. coll. ; on *Anthriscus sylvestris* • 1 ♀; Bilstain (Forêt Domaniale de Grunhaut), LG; 20 Jun. 1961; Wolf 1968 • 1 ♀; Vivy, LX; 2 Jun. 1962; Wolf 1968 • 1 ♂; Rhisnes, NA; 4 Jun. 1962; Wolf 1968 • 1 ♀; La Roche-en-Ardenne, LX; 7 Jun. 1964; Wolf 1968 • 1 ♂; Neuchâteau, LX; 23 May 1965; Wolf 1968 • 1 ♀; Louveigné (Sendrogne), LX; 19 Jun. 1965; Wolf 1968 • 1 ♀; Musson, LX; 30 May 1966; Wolf 1968 • 1 ♂; Beaufays, LG; 12 May 1979; Magis 1983 • 1 ♀; Beaufays, LG; 28 May 1979; Magis 1983 • 2 ♀; Sart Tilman, LG; 2 Jun. 1979; Magis 2007; A. Pauly leg. coll. • 1 ♀; Beaufays, LG; 7 Jun. 1979; Magis 1983 • 1 ♀; Beaufays, LG; 19 Jun. 1979; Magis 1983 • 1 ♂; Bomal, LX; 18 May 1982; Magis 1983 • 1 ♀; La Louvière, HA; 10 May 1987; Magis 2007 • 1 ♂; Eben-Emael, LG; 24 May 1996; Magis 2007 • 1 ♀; Grand-Manil, NA; 5 May 2000; Magis 2007 • 1 ♀; Ukkel, BR; 24 May 2004; Magis 2007 • 1 ♀; Somal, NA; 24 Aug. 2006; Magis 2007 ; P- N. Libert leg. coll. ; on *Daucus carota* • 1 ♀; Somal, NA; 16 May 2010; Libert & Magis 2015 • 1 ♀; Brussel, BR; 23 Jun. 2010; observations.be; J. Soors leg. • 1 ♂; Arlon, LX; 26 May. 2012; observations.be; M. Pédron leg. • 1 ♀; Heverlee, VB; 26 May. 2012; observations.be; J. R. leg. • 1 ♀; Evere, BR; 9 Jun. 2013; observations.be; B. Hanssens leg. • 1 ♀; Tellin, LX; 12 May 2017; observations.be; J. Preud'homme leg. • 1 ♀; Roosdaal, VB; 12 Jun. 2017; observations.be; K. Geeraerts leg. • 1 ♂; Kortrijk, WV; 22 May 2018; observations.be; C. Delbaere leg. • 1 ♀; Spa, LX; 31 May 2018; observations.be; C. Devillers leg. • 1 ♀; Bevere, OV; 8 Jun. 2018; observations.be; W. Van Heddegem leg. • 1 ♀; Willebroek, AN; 16 May 2019; observations.be; M. Mergaerts leg. • 1 ♂; Lozer, OV; 21 May 2019; observations.be; J. Raes leg. • 1 ♀; Rotselaar, VB; 23 May 2019; observations.be; M. Mergaerts leg. • 1 ♀; Nazareth, OV; 1 Jun. 2019; observations.be; J. Raes leg. • 1 ♀; Vresse-sur-Semois, NA; 8 Jun. 2019; observations.be; D. Duytschaever leg. • 1 ♂; Kanne, LI; 13 Jun. 2019; observations.be; J. Slaats leg. • 1 ♀; Schoten, AN; 14 Jun. 2019; observations.be; K. Bracke leg. • 1 ♀; Melsen; 18 Jun. 2019; observations.be; J. Raes leg.

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Rosa-type specimen (see Remarks)

1 ♀; Aarschot, VB; 5 Jun. 2016; observations.be; R. Vandenhoudt leg.; oviposition on *Rosa* spp. • 1 ♀; Roeselare, WV; 11 May 2018; observations.be; L. Feys leg. • 1 ♀; Oudenaarde, OV; 15 May 2018; observations.be; J. Raes leg.

Morphology

Belonging to species-complex A (see Table I), *P. niger* closely resembles *P. faunus*. Microscopic features are differences in the colouration of the mandibles (middle part dark brown in females, yellow in males), differences in punctuation of frons and prothorax (matt) and the length of the vertex. Adults raised from *Rosa* spp. are recognised by having red brown antennal segments apically (see remarks). For photography, as with *P. faunus*, we have to distinguish between females and males, the latter in some populations being extremely rare. Females generally appear to have somewhat broader stripes or markings instead of stains, often completely white or creamy. Males are harder to distinguish on superficial features. According to Jansen (1998) the posterior side of the front legs of *P. niger* is yellow, but black in *P. faunus*.

Fig. 3a. *Phylloecus niger* ♀, leg. K. Geeraerts; Belgium, Roosdaal, 12 Jun. 2017, © K. Geeraerts.

Distribution

Accepting the possible difficulties in identification, *P. niger* seems at present to be the common species in Belgium. So far, as mentioned above, *P. faunus* has yet to be reported here. In fact, of the whole genus, *P. niger* is most commonly seen. However, older data is largely missing for Flanders, with the exception of some specimens collected around Brussels (Fig. 3b). Even then, gaps can be identified in our records: between 1966 and 1979 no data are available and between 1982 and 2010 records are scarce. Recently the tables turned with the new citizen science portal observations.be. From 2010 onwards 21 new records have become available from all Provinces (but most from Flanders), thus constituting nearly half of the 51 records in total.

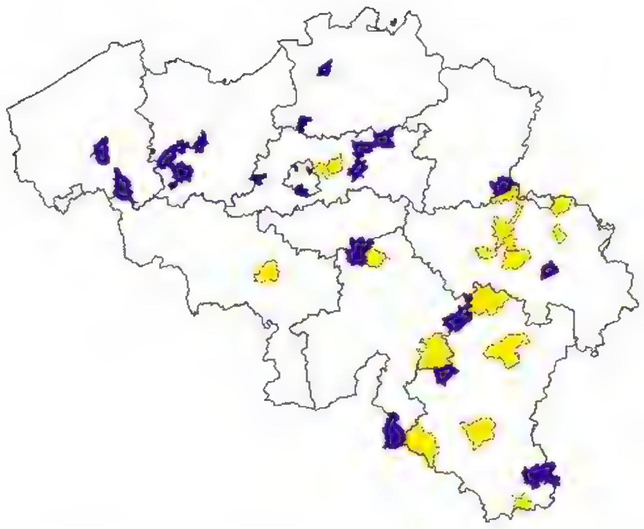

Fig. 3b. Distribution of Phylloecus niger (purple = observations after 2000).

Remarks

Distribution and frequency of *P. niger* is largely based on its ecology. The other species are mostly restricted to a single plant species. *P. niger* can not only be found on many *Rubus*-species, including *R. idaeus* as well as *R. fruticosus* agg., but also on *Rosa* spp. This is also why the Dutch vernacular name 'Brame[n]stengelboorder' or Blackberry-stemborer (De Jong 1964) – in fact, as one of the oldest vernacular names for a sawfly in Dutch – is a bit ambiguous.

Fig. 3c. *Phylloecus niger* ♀ '*Rosa*-type', leg. R. Vandenhoudt; Belgium, Aarschot, 5 Jun. 2016. © R. Vandenhoudt.

Having reared adults from *Rosa* spp. (Scheibelreiter 1973), it was noticed that the antennal segments of adults are red brown, in contrast to those associated with *Rubus* sp. which have black antennae (Jansen 1998). We are able to confirm this difference. One female specimen was photographed ovipositing on *Rosa* spec. (Fig. 3c) and the antennae are certainly different in this respect (Fig. 3d). However, we are able to specify in more detail: the first three flagellomeres are blackish, the distal part is red brown. This is also visible on other photographs, and if the difference turns out to be constant, its taxonomic significance will require investigation. At this stage it is still not clear whether this is merely a variation, or whether

the morph merits subspecific or even specific status (which we could call 'Rozenstengelboorder').

Fig. 3d. *Phylloecus niger* ♀ '*Rosa*-type', leg. R. Vandenhoudt; Belgium, Aarschot, 5 Jun. 2016. © R. Vandenhoudt.

Phylloecus xanthostoma (Eversmann, 1847) Moerasspireastengelboorder Reported specimens

• 1 ♀; Loën, LG; 21 Jul. 1933; Crèvecoeur & Maréchal 1940 • 1 ♂; Barvaux-sur-Ourthe, LX; 9 Jun. 1934; Crèvecoeur & Maréchal 1939 • 1 ♀; Bombaye, LG; 12 Jun. 1934; Crèvecoeur & Maréchal 1940 • 1 ♀; Comblain-au-Pont, LG; 9 Jul. 1935; Crèvecoeur & Maréchal 1939 • 1 ♀; Lanaye, LG; 14 Jul. 1935; Wolf 1968 • 1 ♂; Melle, OV; 15 Jun. 1944; Wolf 1968 • 1 ♂; Lixhe (Montagne St-Pierre), LG; 1 Jul. 1944; Crèvecoeur & Maréchal 1939 • 2 ♂; Heusden, OV; 10 Jun. 1945; Wolf 1968 • 1 ♀; Spa, LX; 1 Jun. 2008; observations.be; C. Devillers leg. • 1 ♀; Somal, NA; 6 May 2011; Libert & Magis 2015 • 1 ♀; Heverlee, VB; 4 Jun. 2011; observations.be; J. R. leg. • 1 ♀; Marchin (Triffoy), LG; 29 May 2015; observations.be; P. Vanmeerbeeck leg. • 1 ♀; Denderbelle, OV; 13 Mar. 2019; observations.be; R. Meert leg ; F. Verheyde coll.; reared • 1 ♀; Kalken, OV; 19 May 2019; observations.be; G. Van Heghe leg. • 1 ♀; Schulen, LI; 6 Jun. 2019; observations.be; K. Hustinx leg. • 1 larva; Rochefort, NA; 20 Sept. 2019; observations.be; R. Meert leg.

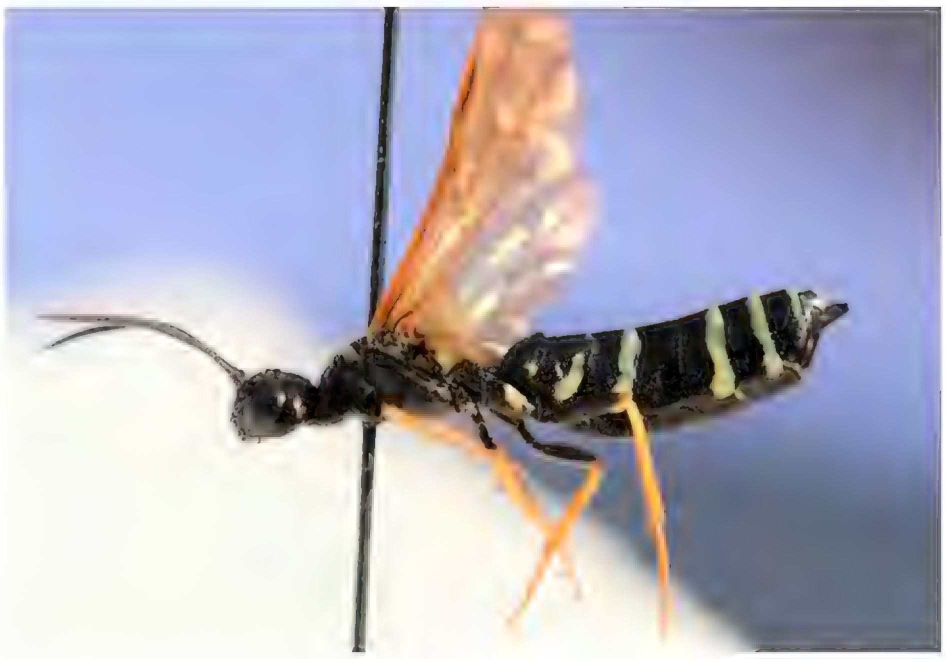

Fig. 4a. *Phylloecus xanthostoma* ♀, coll. F. Verheyde; leg. R. Meert, Belgium, Denderbelle 2019, ex *Filipendula ulmaria*. © F. Verheyde.

Morphology

Belonging to species-complex B (see Table II), *P. xanthostoma* closely resembles *P. linearis*. Females of *P. xanthostoma* always have a black scutellum (Figs. 4a-b.) and the yellow dots on the clypeus are rather small and scattered, or obsolescent (Fig. 4c). Males are very hard to distinguish; except for a small difference in the shape of the vertex behind the ocelli (Burggraaf-van Nierop & van Achterberg 1990) and the length of the fourth antennal segment, no clear differences are known. This is why '*Hartigia* spec.' on citizen science portals mostly contains males of the *Hartigia linearis/xanthostoma*-complex.

Fig. 4b. *Phylloecus xanthostoma* ♀, coll. F. Verheyde; leg. R. Meert, Belgium, Denderbelle 2019, ex *Filipendula ulmaria*. © F. Verheyde.

Fig. 4c. *Phylloecus xanthostoma* ♀, coll. F. Verheyde; leg. R. Meert, Belgium, Denderbelle 2019, ex *Filipendula ulmaria*. © F. Verheyde.

Distribution

With *Filipendula ulmaria* as a host plant, *P. xanthostoma* should be more common than *P. linearis*, especially in Flanders (Fig. 4d). This shows on our

distributional map, but from a broader perspective differences remain small.

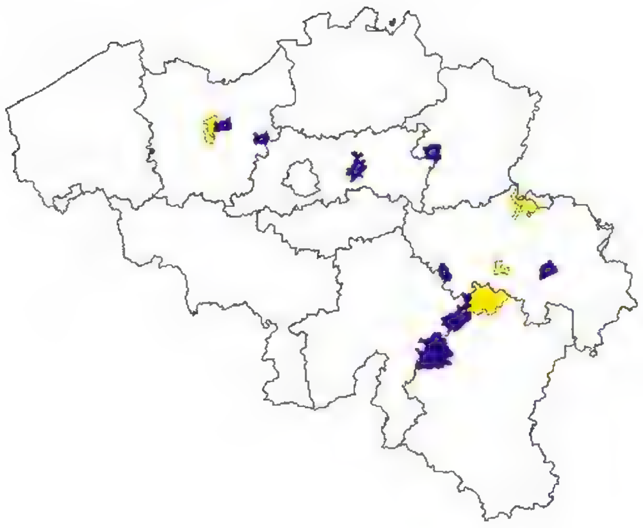

Fig. 4d. Distribution of *Phylloecus xanthostoma* (purple = observations after 2000).

Fig. 5a. *Phylloecus xanthostoma* larva on host plant; leg. R. Meert, Belgium, Sart-en-Fagne 2019, ex *Filipendula ulmaria*. © R. Meert.

Fig. 5b. *Phylloecus xanthostoma* larva on host plant; leg. R. Meert, Belgium, Sart-en-Fagne 2019, ex *Filipendula ulmaria*. © R. Meert.

Fig. 5c. *Phylloecus xanthostoma* larva on host plant; leg. R. Meert, Belgium, Sart-en-Fagne 2019, ex *Filipendula ulmaria*. © R. Meert.

Fig. 5d. *Phylloecus xanthostoma* larva on host plant; leg. R. Meert, Belgium, Sart-en-Fagne 2019, ex *Filipendula ulmaria*. © R. Meert.

Remarks

In September 2018, three full grown larvae of *P. xanthostoma* were found in a stem of *Filipendula ulmaria* by the second author. Not surprisingly, bearing in mind the preferences of this plant, the plants were growing in wet conditions at the waterside of the river Dender in Denderbelle (East Flanders). All larvae were final instars and were located in the centre of the stem of the host plant. One stem of *F. ulmaria* contained two larvae of *P. xanthostoma*, thus confirming the grouping of larvae stated in literature. A transparent white cocoon up to 6 cm was made, having the same diameter as the central hole in the stem. In the cocoon, the larva was resting head upwards (Fig. 5c).

In other parts of the stem, brown frass was noticed (see also Fig. 5b). Pupae were not checked during rearing to prevent a possible failure of the breeding experiments. To leave the feeding place, the adult gnawed a hole in the stem close to the top of the cocoon. Larvae of the micromoth *Monochroa lutulentella* (Zeller, 1839) can be found in the same host plant and period as *P. xanthostoma*, but they live in the rootstock and the very base of the stem (personal observations from the second author).

Fig. 6. *Phylloecus linearis* larva on host plant; leg. R. Meert, Belgium, Rochefort 2019, ex *Agrimonia eupatoria*. © R. Meert.

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New records and an updated checklist of the butterfly fauna (Lepidoptera: Papilionoidea) of Puglia, south-eastern Italy

Giuseppe Cagnetta, Rocco Labadessa, Enrico Altini, Daniela Clemente & Alessio Vovlas

Abstract. An updated checklist of Rhopalocera occurring in Puglia region, in the south-eastern part of the Italian Peninsula, is presented, together with their occurrence status. Surveys were made from 2007 to 2020, and 110 butterfly species from 6 families, including several confirmations of historical published records, were encountered. Among these, threatened species such as *Zerynthia cassandra*, *Melanargia arge*, and *Euphydryas aurinia* should be mentioned. Including all the published records, the total number of butterfly species recorded in Puglia is 120, which amounts to 40% of the total Italian and approximately 24% of the total European butterfly fauna. A revised checklist represents a starting point for further research, provides a foundation for future butterfly conservation actions and implies that more research is needed, to increase the general knowledge of the butterfly fauna in South Italy.

Riassunto. Il presente lavoro riporta un elenco aggiornato delle farfalle diurne presenti in Puglia nella parte sud-orientale della penisola italiana, corredato dalle relative località di contatto. Le indagini sono state condotte dal 2007 al 2020. In questo periodo sono state censite 110 specie di farfalle appartenenti a 6 famiglie, tra cui diverse conferme di segnalazioni presenti in precedenti pubblicazioni. Tra queste, vanno menzionate alcune specie minacciate a livello europeo come *Zerynthia cassandra*, *Melanargia arge*, *Euphydryas aurinia*. Comprendendo tutte le segnalazioni già presenti in pubblicazioni pubblicate in passato, il numero totale di specie di farfalle registrate ad oggi in Puglia è di 120 specie, che equivale al 40% del totale italiano e circa il 24% della fauna europea totale delle farfalle. Una checklist rivista e aggiornata rappresenta un punto di partenza per future azioni di conservazione delle farfalle e implica la necessità di ulteriori ricerche, per aumentare le conoscenze generali sulla fauna delle farfalle nel Sud Italia.

Samenvatting. Een bijgewerkte checklist van Rhopalocera die voorkomen in de regio Apulië, in het zuidoostelijke deel van het Italiaanse schiereiland, wordt gepresenteerd, samen met de status van voorkomen. Van 2007 tot 2020 werden enquêtes gehouden en 110 vlindersoorten uit 6 families, waaronder verschillende bevestigingen van historische, gepubliceerde gegevens, werden aangetroffen. Onder deze moeten bedreigde soorten zoals *Zerynthia cassandra*, *Melanargia arge* en *Euphydryas aurinia* worden genoemd. Met inbegrip van alle gepubliceerde gegevens, is het totale aantal geregistreerde vlindersoorten in Apulië 120, wat neerkomt op 40% van de totale Italiaanse en ongeveer 24% van de totale Europese dagvlinderfauna. Een herziene checklist vormt een startpunt voor verder onderzoek, biedt een basis voor toekomstige vlinderbeschermingsacties en impliceert dat er meer onderzoek nodig is om de algemene kennis van de vlinderfauna in Zuid-Italië te vergroten.

Key words: Biodiversity – Distribution – Faunistics – Rhopalocera – Taxonomy.

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Introduction

The first in-depth studies of the butterfly fauna of Puglia commenced at the beginning of the 20th Century. Important research was undertaken by Cecconi (1908), who published a report on the butterfly species encountered on the Tremiti Islands. Numerous other entomological surveys were conducted by different researchers during the following years. Wimmers (1931) published an inventory of the butterflies of Gargano. Significant new additions were reported by De Togni (1948) for the same geographical area. A few surveys were conducted later in Gargano, Arco Jonico, Salento and Terra di Bari by Zangheri (1956, 1960). The first comprehensive overview of the butterfly fauna for Puglia was compiled by Parenzan (1975, 1980), who collected specimens in several locations, providing personal records for most of the species. Balletto & Toso (1982) provided new observations and ecological data from surveys on coastal dune biotopes of Southern Italy, including Puglia.

Almost thirty years passed until summaries of butterfly species in this region were compiled by Bruno (2002) and Russo (2004). A review of the data based on the available literature was later published by Parenzan & Porcelli (2006). Recently, a systematic list for the Salento area was composed by Durante (2009). Since then, further efforts have been made to fill the gaps in the knowledge of the presence of butterflies in Puglia (Zilli 1998, Cicerale 2007, Cagnetta 2016).

A comprehensively updated checklist of the butterflies of Puglia is overdue and is presented in this paper, together with a historical overview of entomological records. A review of the published records is presented in Table 2.

Study area

Puglia is a region located in the south-eastern part of Italy. Its total area is 19,358 km² and it is one of the flattest regions in Italy: flat and plain areas cover over 50% of its surface, with only 1.5% covered by mountains. Puglia has more than 800 km of coastline, which is longer than that of any other Italian region. Puglia is dominated by a Mediterranean microclimate with warm, dry and sunny summers and mild, rainy winters with 15–16° C average annual temperature. The Adriatic side is affected by the continental climate caused by the mountainous complexes of the north-eastern sector and by the

extensive plains of eastern Europe, gradually attenuated towards the south by the influence of the eastern Mediterranean. The north-western part is influenced by the mountain climate of the nearby Apennines (Macchia *et al.* 2000).

Considering the different peculiarities at geomorphological and landscape level, the study took place in eight different sub-regions: Tavoliere delle Puglie, Gargano, Subappennino Dauno, Alta Murgia, Terra di Bari, Valle d'Itria, Arco jonico and Salento.

Tavoliere delle Puglie is the second largest Italian plain (approximately 4300 km^2) and the largest alluvial plain in the Italian peninsula, overlaying Plio-Pleistocene marine sandy-gravelly deposits (Di Rita *et al.* 2011). Human activity through the ages has generated increasing pressure on the area, and cultivation, with massive cereal production, has progressively replaced the natural steppe vegetation since the 6th millennium B.C. (Baker *et al.* 1987).

The Gargano peninsula forms an elevated area of around 2,000 km^2 along the south-eastern Adriatic coastline. Deciduous mesophilous woods are spread on the promontory. "Foresta Umbra" may be considered one of the most important residual millenary forests of woods and pastures in Italy and is famous for an extraordinarily rich flora and beech stands, which are unique for SE-Italy. Karst phenomena reduce the hydrographic characteristics, but significant is the presence of two coastal lagoons, the Lesina and Varano Lakes.

Subappennino Dauno, in the northwest of the region, is characterized by hills and modest relief overall, where the highest peak is Mt. Cornacchia (1,151 m), degraded and engraved by a system of waterways that flow towards the Tavoliere delle Puglie plain. Lake Occhito, situated at the boundaries with the Molise region, is one the largest artificial reservoirs in Europe. The landscape is mainly cultivated with durum wheat and interspersed with small strips of oak woods.

Alta Murgia is a calcareous highland with a geological soil substrate mainly consisting of Cretaceous limestones. The typical Mediterranean vegetation of the area includes semi-natural dry grasslands, residual patches of downy oak forests, scrub, pastures and land harvested for seasonal crops. Serious alterations to the morphology of the area have been brought about through a combination of natural and anthropogenic processes over long periods by the practice of "rock-breaking" often applied to turn the original pasture to cropped land (Perrino *et al.* 2012), sheep grazing, cutting and deliberate light burning regimes (Labadessa 2014). The upper part of this area, spanning over 125,880 ha and ranging from about 300 to 700 m.a.s.l., is in part designated as a National Park.

The Terra di Bari extends between the last slopes of Murgia gradually dipping toward the Adriatic Sea and the coastline and represents relict landforms associated with ancient sea-level changes that occurred during the Middle and Late Pleistocene (Gioia *et al*. 2010). The more fertile lower flatter area is mainly used for irrigated fruit and vegetable crops, while the inner part, on the foothills of the first karst steps, is dominated by vineyards and intensive crops of olive, cherry and almond trees.

Valle d'Itria is characterized by the strong presence of karst morphologies, which articulate and fragment the landscape. The plateau is almost entirely made up of a dolomite limestone bank, locally covered by recent calcarenitic rocks or red clayey residual material (called "terra rossa") a product of the dissolution of limestone. The presence of a limestone soil is very important for the vineyards, one of the main crops in the area.

Arco Jonico is characterized by the particular orographic conformation of the karst environment, consisting in the succession of steps and terraces with peculiar features, besides an interspersed network of deep gorges locally called "gravine", with which the Murgia plateau slopes towards the sea, forming a kind of natural amphitheatre. The vegetation has a great biogeographic interest because of the eastern-Mediterranean floristic contingent, associated with a good western component (Biondi & Guerra 2008).

Salento is characterized by an alternation of flat areas, variously extended, with very low relief. The natural landscape in Salento is the consequence of thousands of years of human activity: agriculture, deforestation and forest fires have together deeply altered the natural vegetation, which is therefore extremely threatened and concentrated in small patches of maquis or its degradation forms, xeric grasslands and garrigue (Mele *et al.* 2006).

Although it is a small region, Puglia is notable for its rich landscape and biological diversity. Despite the fact that butterflies are one of the most studied insect groups in the World in southern Italy they are still understudied. Girardello *et al*. (2008) showed that the most important areas for butterflies in Italy are the Alps, the central Apennines, the island of Sardinia and the Puglia region.

Material and Methods

The checklist of the butterflies of Puglia presented in this work is based on records from all the available literature known to the authors and includes many records and new findings, mainly unpublished data from the authors and personal observations collected between 2007 and 2020. During the surveys, butterflies were observed, photographed and identified in the field, with only a few specimens collected for further examination. Identification was based on Tolman & Lewington (2008) and Lafranchis (2004). Taxonomy and nomenclature follow Wiemers *et al*. (2018) and van Nieukerken *et al.* (2019). Subspecific taxa are not included in the checklist.

In total, 44 different localities were visited. The locations listed correspond approximately to the municipal limits of the sampled location (Table 1; Fig. 1).

Results and discussion

110 butterfly species from 6 families were encountered during surveys from 2007 to 2020, including several confirmations of historical published records. Including a systematic revision of the records from literature, the butterfly fauna of Puglia contains a total of 120 species.

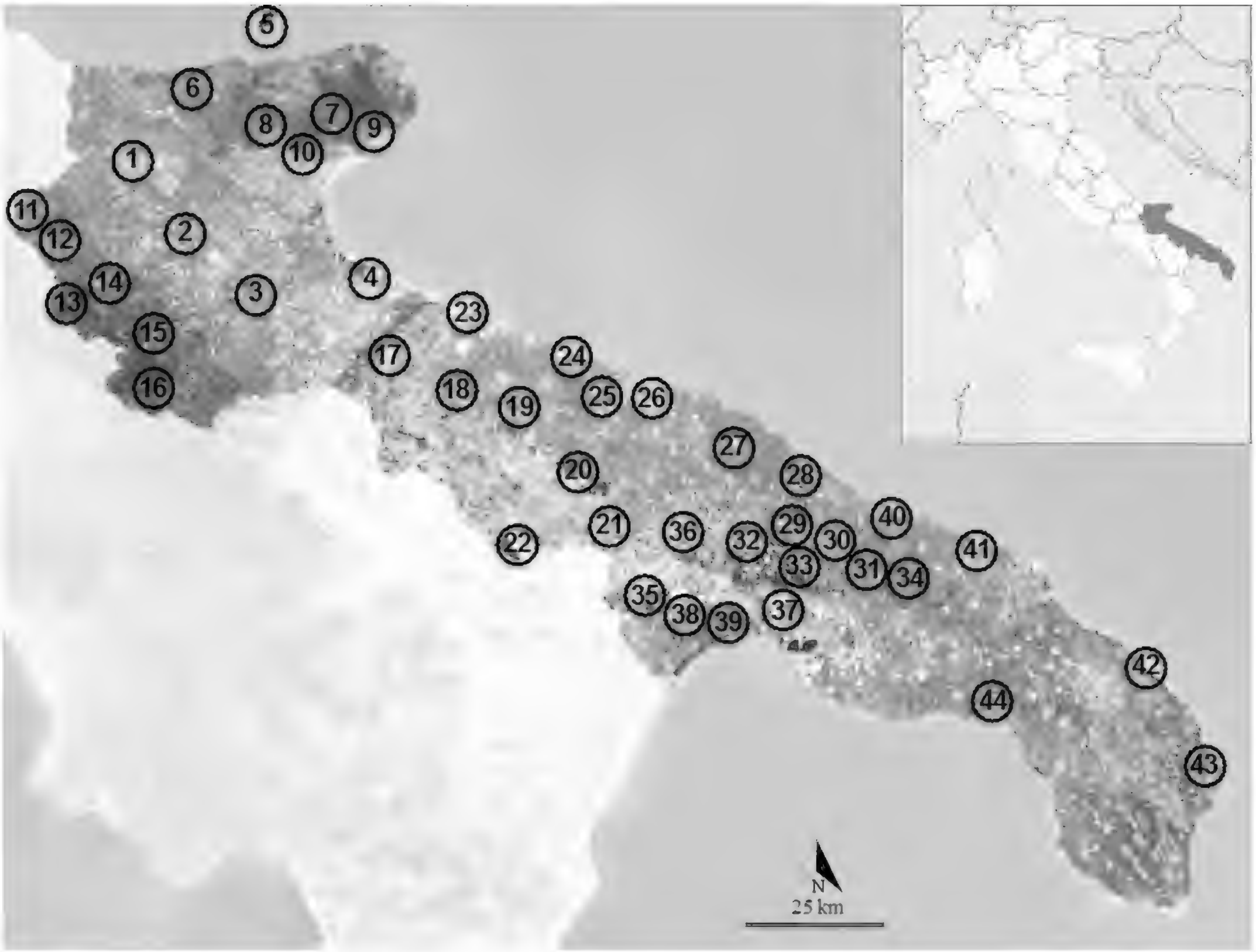

Fig. 1. Map of Puglia with the position of study locations. Study locations are listed in Table 1.

Checklist of butterfly species of Puglia

Family Hesperiidae

1. *Carcharodus alceae* (Esper, 1780)
2. *Carcharodus baeticus* (Rambur, 1839)
3. *Carcharodus floccifera* (Zeller, 1847)
4. *Erynnis tages* (Linnaeus, 1758)
5. *Gegenes nostrodamus* (Fabricius, 1793)
6. *Gegenes pumilio* (Hoffmannsegg, 1804)
7. *Hesperia comma* (Linnaeus, 1758)
8. *Muschampia proto* (Ochsenheimer, 1808)
9. *Ochlodes sylvanus* (Esper, 1777)
10. *Pyrgus armoricanus* (Oberthür, 1910)
11. *Pyrgus carthami* (Hübner, 1813)
12. *Pyrgus malvoides* (Elwes & Edwards, 1897)
13. *Pyrgus onopordi* (Rambur, 1839)
14. *Pyrgus sidae* (Esper, 1784)
15. *Spialia sertorius* (Hoffmannsegg, 1804)
16. *Thymelicus acteon* (Rottemburg, 1775)
17. *Thymelicus lineola* (Ochsenheimer, 1808)
18. *Thymelicus sylvestris* (Poda, 1761)

Family Papilionidae

19. *Iphiclides podalirius* (Linnaeus, 1758)
20. *Papilio machaon* (Linnaeus, 1758)
21. *Zerynthia cassandra* (Geyer, 1828)

Family Pieridae

22. *Anthocharis cardamines* (Linnaeus, 1758)
23. *Aporia crataegi* (Linnaeus, 1758)
24. *Colias alfacariensis* (Ribbe, 1905)
25. *Colias croceus* (Geoffroy, 1785)
26. *Euchloe ausonia* (Hübner, 1804)
27. *Gonepteryx cleopatra* (Linnaeus, 1767)
28. *Gonepteryx rhamni* (Linnaeus, 1758)
29. *Leptidea sinapis* (Linnaeus, 1758)
30. *Pieris brassicae* (Linnaeus, 1758)
31. *Pieris ergane* (Geyer, 1828)
32. *Pieris mannii* (Mayer, 1851)
33. *Pieris napi* (Linnaeus, 1758)
34. *Pieris rapae* (Linnaeus, 1758)
35. *Pontia edusa* (Fabricius, 1777)

Family Riodinidae

36. *Hamearis lucina* (Linnaeus, 1758)

Family Lycaenidae

37. *Aricia agestis* (Denis & Schiffermüller, 1775)
38. *Cacyreus marshalli* (Butler, 1898)
39. *Callophrys rubi* (Linnaeus, 1758)
40. *Celastrina argiolus* (Linnaeus, 1758)
41. *Cupido alcetas* (Hoffmannsegg, 1804)
42. *Cupido argiades* (Pallas, 1771)
43. *Cupido minimus* (Fuessly, 1775)
44. *Cupido osiris* (Meigen, 1829)

45. *Cyaniris semiargus* (Rottemburg, 1775)
46. *Eumedonia eumedon* (Esper, 1780)
47. *Favonius quercus* (Linnaeus, 1758)
48. *Glaucopsyche alexis* (Poda, 1761)
49. *Iolana iolas* (Ochsenheimer, 1816)
50. *Lampides boeticus* (Linnaeus, 1767)
51. *Leptotes pirithous* (Linnaeus, 1767)
52. *Lycaena alciphron* (Rottemburg, 1775)
53. *Lycaena phlaeas* (Linnaeus, 1761)
54. *Lycaena thersamon* (Esper, 1784)
55. *Lycaena tityrus* (Poda, 1761)
56. *Phengaris arion* (Linnaeus, 1758)
57. *Plebejus argus* (Linnaeus, 1758)
58. *Plebejus argyrognomon* (Bergsträsser, 1779)
59. *Plebejus idas* (Linnaeus, 1761)
60. *Polyommatus amandus* (Schneider, 1792)
61. *Lysandra bellargus* (Rottemburg, 1775)
62. *Lysandra coridon* (Poda, 1761)
63. *Polyommatus daphnis* (Denis & Schiffermüller, 1775)
64. *Polyommatus dolus* (Hübner, 1823)
65. *Polyommatus dorylas* (Denis & Schiffermüller, 1775)
66. *Polyommatus escheri* (Hübner, 1823)
67. *Polyommatus icarus* (Rottemburg, 1775)
68. *Polyommatus thersites* (Cantener, 1835)
69. *Pseudophilotes baton* (Bergsträsser, 1779)
70. *Satyrium acaciae* (Fabricius, 1787)
71. *Satyrium ilicis* (Esper, 1779)
72. *Satyrium spini* (Denis & Schiffermüller, 1775)
73. *Satyrium w-album* (Knoch, 1782)
74. *Thecla betulae* (Linnaeus, 1758)

Family Nymphalidae

75. *Aglais io* (Linnaeus, 1758)
76. *Aglais urticae* (Linnaeus, 1758)
77. *Argynnis adippe* (Denis & Schiffermüller, 1775)
78. *Speyeria aglaja* (Linnaeus, 1758)
79. *Fabriciana niobe* (Linnaeus, 1758)
80. *Argynnis pandora* (Denis & Schiffermüller, 1775)
81. *Argynnis paphia* (Linnaeus, 1758)
82. *Boloria euphrosyne* (Linnaeus, 1758)
83. *Brenthis daphne* (Bergsträsser, 1780)
84. *Brenthis hecate* (Denis & Schiffermüller, 1775)
85. *Charaxes jasius* (Linnaeus, 1767)
86. *Chazara briseis* (Linnaeus, 1764)
87. *Euphydryas aurinia* (Rottemburg, 1775)
88. *Issoria lathonia* (Linnaeus, 1758)
89. *Libythea celtis* (Laicharting, 1782)
90. *Limenitis reducta* (Staudinger, 1901)
91. *Melitaea celadussa* Fruhstorfer, 1910
92. *Melitaea cinxia* (Linnaeus, 1758)
93. *Melitaea didyma* (Esper, 1778)
94. *Melitaea ornata* Christoph, 1893
95. *Melitaea phoebe* (Denis & Schiffermüller, 1775)
96. *Melitaea trivia* (Denis & Schiffermüller, 1775)
97. *Nymphalis antiopa* (Linnaeus, 1758)
98. *Nymphalis polychloros* (Linnaeus, 1758)
99. *Polygonia c-album* (Linnaeus, 1758)
100. *Polygonia egea* (Cramer, 1775)
101. *Vanessa atalanta* (Linnaeus, 1758)
102. *Vanessa cardui* (Linnaeus, 1758)
103. *Brintesia circe* (Fabricius, 1775)
104. *Coenonympha arcania* (Linnaeus, 1760)
105. *Coenonympha pamphilus* (Linnaeus, 1758)
106. *Danaus chrysippus* (Linnaeus, 1758)
107. *Hipparchia fagi* (Scopoli, 1763)
108. *Hipparchia semele* (Linnaeus, 1758)
109. *Hipparchia statilinus* (Hufnagel, 1766)
110. *Hyponephele lupinus* (Costa, 1836)
111. *Hyponephele lycaon* (Kühn, 1774)
112. *Lasiommata maera* (Linnaeus, 1758)
113. *Lasiommata megera* (Linnaeus, 1767)
114. *Maniola jurtina* (Linnaeus, 1758)
115. *Melanargia arge* (Sulzer, 1776)
116. *Melanargia galathea* (Linnaeus, 1758)
117. *Melanargia russiae (*Esper, 1783)
118. *Pararge aegeria (*Linnaeus, 1758)
119. *Pyronia cecilia* (Vallantin, 1894)
120. *Pyronia tithonus* (Linnaeus, 1771)

Table 1. List of surveyed localities.

Tavoliere delle Puglie	**Subappennino Dauno**	**Terra di Bari**	**Arco Jonico**
1. Torremaggiore	11. Occhito	23. Barletta	35. Laterza
2. Bosco Incoronata	12. San Marco la Catola	24. Giovinazzo	36. Gioia del Colle
3. Lucera	13. Faeto	25. Lama Balice	37. Crispiano
4. Zapponeta	14. Biccari	26. Bari	38. Castellaneta
Gargano	15. Bovino	27. Conversano	39. Pinete dell'Arco jonico
5. Tremiti islands	16. Accadia	28. Monopoli	**Salento**
6. Lesina	**Alta Murgia**	**Valle d'Itria**	40. Torre Canne
7. Foresta Umbra	17. Locone	29. Alberobello	41. Torre Guaceto
8. S. Marco in Lamis	18. Corato	30. Locorotondo	42. S. Cataldo
9. Mattinata	19. Ruvo di Puglia	31. Cisternino	43. Otranto
10. Monte S. Angelo	20.Cassano delle Murge	32. Noci	44. Pulsano
	21. Santeramo in colle	33. Pianelle	
	22. Gravina	34. Ostuni	

In Appendix 1, a table with localities where the specimens were sampled is presented.

In a recently published new finding, *Melitaea ornate* and *Melitaea trivia* (Fig. 2), are reported for the first time in a list of Apulian butterflies (Cagnetta 2016). Concerning the congeneric species *M. celadussa*, it has long been known that *Melitaea athalia* and *M. celadussa* (often referred to as *M. nevadensis*) are separate taxa (Balletto *et al*. 2014) based on genitalia morphology. With the current knowledge on the distribution of these taxa, we refer all our past observations of *M. athalia* to *M. celadussa* (see van Oorschot & Coutsis 2014). De Togni (1948) attributes specimens collected in Gargano to *M. athalia* var. *divergens*, but Zangheri (1956) regarded this assignment as questionable, as this variety was considered typical of the Po Valley, in northern Italy. Parenzan (1975) provided a reliable identification of specimen collected in Valle d'Itria (Pianelle) assigned to *Melitaea athalia celadussa.* Authors documented its presence also in Subappennino Dauno.

Fig. 2a. *Melitaea ornata*, Monti Dauni, June 2013. © Giuseppe Cagnetta.
Fig. 2b. *Melitaea trivia*, Monti Dauni, June 2013. © Giuseppe Cagnetta.

With our recent field surveys, we confirm the presence of *Hamearis lucina*, *Lycaena alciphron, Cupido osiris, Iolana iolas and Polyommatus escheri* in Puglia. Apart from its inclusion by Wimmers (1931), who described it as "not rare" for Gargano, the presence of *H. lucina* (Fig. 3b) has not been reported in any other published record. During the surveys, this species was found in the surrounding of Biccari, Subappennino Dauno, in 2014. The scarcity of data can perhaps be attributed to a lack of surveys in this part of the region. *Lycaena alciphron* was first observed by Wimmers (1931) and De Togni (1948) in Gargano. This historical record was confirmed by the authors, who observed several specimens flying in June 2018 in the same location after 70 years. *Cupido osiris* was previously reported only by Russo (2004) in Accadia, but our recent observations in other localities suggest that it is likely to be more widespread in the Subappennino Dauno area. *Iolana iolas* (Fig. 4a) was reported by Chiavetta (2001) for Gargano, and it was also mentioned for the vicinity of Volturara Appula, in Subappennino Dauno, during June 1983 (Cicerale 2007). Specimens were mainly worn observed at the end of May 2020 in the vicinity of Accadia. Among these records, one of the most notable is the presence of *Polyommatus escheri* in Gargano and Subappennino Dauno. This is an apparently rare lycaenid butterfly that could be easily overlooked due to its similarity with other Polyommatinae butterflies.

The presence of some species included in the list requires confirmation. There is just a single report of the occurrence of *Hesperia comma* and *Thecla betulae* in Puglia (Cicerale 2007), near Monte Cornacchia.

The first documented record of *Eumedonia eumedon* is in Wimmers (1931) for Gargano. This species has only a recent record in Subappennino Dauno in 1986 (Cicerale 2007). *Polyommatus dorylas* was first reported from Gargano by Wimmers (1931) too. For the same location, Parenzan & Porcelli (2006) reported a personal communication by Bertaccini with a precise locality and date of sighting (Peschici, Baia di Manaccora, 28 June 1995). Later, *P. dorylas* was recorded in Subappennino Dauno (Cicerale 2007). There are no more recent sightings for any of these butterflies, and their presence also requires confirmation. Wimmers (1931) reported *Hyponephele lycaon* var. *lupina* for Gargano, but in all probability should be referred to *H. lupinus*. However, in 1983, Cicerale (2007) observed a single female of *H. lycaon* in the surrounding of a forest in Gargano. The presence needs to be confirmed as there is no photographic record or voucher specimen.

Based on records from data gathering from older literature, three species are mentioned but have never been re-found. De Togni (1948) and Zangheri (1956) collected many specimens of *Plebejus argyrognomon* from Gargano. Ideal habitats for this species are still

probably available in the same area and, despite the lack of recent records, *P. argyrognomon* is kept on the list on account of historical evidence. Only one report mentions the occurrence of *Pyrgus carthami* in Puglia (Parenzan *et al*. 2006), based on a personal communication by Capelli in 1969 for Bosco Incoronata. Only one published record exists for *Nymphalis antiopa* for Monti Dauni and Arco Jonico (Parenzan 1980). We consider *N. antiopa* as a potential species to be rediscovered in the future and forthcoming activities should be focused on the confirmation of this older historical record. Other questionable occurrences have been excluded from the list. For example, *Aphantopus hyperantus* and *Hipparchia alcyone* were cited only by Wimmers (1931) for Gargano, but no specimens were collected or documented, and both are therefore excluded. Another species whose presence in Puglia is doubtful is *Carcharodus lavatherae* (Esper, 1780). As its presence is reported only in some field guides (Higgins & Riley 1983, Tolman 2008), it has been removed from the list.

The distribution of many species is still poorly documented because some parts of the region have not yet been surveyed adequately. However, new observations in different sub-regions have been provided for some species.

Fig. 3a. *Melanargia arge,* Cassano delle Murge, May 2012. © Giuseppe Cagnetta.

Fig. 3b. *Euphydryas aurinia,* Monti Dauni, June 2013. © Giuseppe Cagnetta.

Fig. 3c. *Hamearis lucina,* Monti Dauni, June 2014. © Giuseppe Cagnetta.

Fig. 3d. *Zerynthia cassandra*, Cassano delle Murge, April 2011. © Giuseppe Cagnetta.

Hyponephele lupina was mentioned by Parenzan (1975) for Arco jonico, Cicerale (2007) for Subappennino Dauno, and by Durante (2009) for Salento. We collected specimens from localities where *H. lupina* was previously unrecorded, in Gargano (near S. Marco in Lamis and Monte S. Angelo), Alta Murgia (Ruvo di Puglia, Cassano delle Murge), and Terra di Bari (Conversano).

Parenzan (1980) included *Carcharodus baeticus* in the list for the first time, mentioning its presence in the northern part of the region. Specimens were recently observed in the central part of Puglia with new records in Alta Murgia, nearby Corato, Ruvo di Puglia and Cassano delle Murge.

Thymelicus acteon was reported only by Zangheri (1960) for Arco Jonico and Parenzan (1975) for some localities in Arco Jonico and Valle d'Itria. We confirm the presence in the same areas and provide new localities all over the region (see Table S1 for all localities).

During our surveys, *C. alcae* was found in every locality we sampled, while previously it had been reported by De Togni (1948) and Zangheri (1956) only from Gargano, Parenzan (1975) for some localities in Arco Jonico and Valle d'Itria, Balletto & Toso (1982) for Gargano.

As a result of our recent surveys, we provide also new findings for *Melanargia russiae* (fig. 4b). Wimmers (1931) and De Togni (1948) were the first to provide evidence for

M. russiae from Gargano. Later, Parenzan (1975) found it common and widespread in Valle d'Itria and Arco jonico.

We found this species in 14 localities in Gargano (Foresta Umbra, S. Marco in Lamis, Monte S. Angelo, Subappennino Dauno (S. Marco la Catola, Biccari) Alta Murgia (Locone, Corato, Ruvo di Puglia, Santeramo in colle, Gravina), Valle d'Itria (Pianelle), and Arco jonico (Gioia del Colle, Castellaneta).

Two of the newest faunistic elements in the last 20 years in Puglia are *Danaus chrysippus* and *Cacyreus marshalli. Danaus chrysippus* was first observed by Zilli (1988), but was probably already present in South Italy, as documented by Gagliardi (1811). However, during the last twenty years, records of this species have increased in southern Europe, along both sides of the Adriatic coast, for example in Italy in Emilia Romagna (Borgo *et al*. 1992) and also in Albania (Luquet & Misja 1989), Croatia (Perkovij 2006) and Montenegro (Franeta 2018). *D. chrysippus* has been documented in more than 8 localities in all coastal sub-regions, where *Cynancum acutum* is reported as the main host plant. *Cacyreus marshalli* is a South African native Lycaenid accidentally introduced in Europe at the end of the last Century. In Italy it was first observed in 1996 (Trematerra *et al*. 1997) and in recent years it has quickly colonized other Italian regions, including Puglia, with widespread colonies. First reported in Puglia by Russo (2003), we observed that today it occurs throughout Puglia.

Four of the surveyed species are considered threatened species by European and National Red Lists. They are also protected under European Law. *Phengaris arion* is listed as a near threatened (NT) species according to the International Union for the Conservation of Nature (IUCN) Red List Category of Europe. *P. arion* has only been reported for the northern part of Gargano in the past (Wimmers 1931). More recently, it was observed in Monte Cornacchia in 2004 (Cicerale 2007), though its occurrence has not been confirmed recently. Future work should try to verify all locations mentioned and clarify the presence and status of this species in the region.

Zerynthia cassandra (Fig. 3d) is an Italian endemic and Puglia represents the eastern edge of its distribution range. Originally described as a subspecies of the Habitat Directive species (Annex IV) *Zerynthia polyxena*, *Z. cassandra* has recently been upgraded to species rank, due to genitalia and genetic differentiation from *Z. polyxena* (Dapporto 2010, Zinetti *et al*. 2014). Zangheri (1956) reported *Z. polyxena* var. *cassandra* for Gargano; also Parenzan mentioned the species for different localities in Gargano, Arco Jonico and Valle d'Itria. During our surveys, this butterfly was not recorded in any location in Arco jonico, lower part of Salento and Subappennino Dauno areas. The critical resource limiting the occurrence and the persistence of this sedentary and oligophagous species is the availability of a sufficient number of host plants (Vovlas *et al*. 2014). In our surveys, it was observed only on *Aristolochia clusii*, *A. lutea* and *A. rotunda*.

Euphydryas aurinia (Fig. 3b) has suffered a severe decline throughout its European distribution during the twentieth century and for this assessment it is listed in Annex II of the European Community Habitats and Species Directive (92/43/EEC). *E. aurinia* is also included in the Red List of Italian Butterflies (Balletto *et al*. 2015) as Vulnerable (VU). In Puglia this species was first recorded by Cicerale (2007) in Subappennino Dauno. From 2013 and in the following years, authors observed a fairly localized population, but possibly more widespread, in Subappennino Dauno. Researches should be extended to the Gargano area. Other information on the distribution, habitat selection and life cycle needs additional investigation.

Melanargia arge (Fig. 3a) is endemic in central and southern Italy. It is considered threatened in Europe and included in the Annexes II and IV of the Habitats Directive. In the Red List of Italian butterflies, *M. arge* is listed as Least Concern (LC). Simes (1920) mentioned the presence of *M. arge* "...near Brindisi". De Togni (1948) reported the species for the inner part, and Zangheri (1956) documented its presence along the coastal strip of Gargano. During our surveys we encountered this species in more than 20 sites in all sub-regions.

Fig. 4a. *Iolana iolas,* Accadia, May 2020. © Giuseppe Cagnetta.

Fig. 4b. *Melanargia russiae,* Santeramo in colle, June 2012. © Giuseppe Cagnetta.

Conclusion

In this paper we update the known butterfly fauna in Puglia to 120 species, and include a review of the information available in literature, together with recently recorded data. In the checklist, we report new localities and species previously unrecorded in the butterfly fauna of Puglia. The total number of butterfly species recorded amounts to 40% of the total Italian and approximately 24% of the total European butterfly fauna. We emphasise the presence and distribution of remarkable species for butterfly conservation and nature management point of view, such as *Zerynthia cassandra*, *Euphydyas aurinia* and *Melanargia arge*. Questionable occurrences have been excluded from the list, in the absence of voucher specimens or other evidence. For example, *Aphantopus hyperantus* and *Hipparchia alcyone* were cited only by Wimmers (1931) for Gargano. The number of species in Puglia compares favourably with that of neighbouring Italian regions (Sciarretta & Parenzan 2001), considering the geographical context and in spite of the two major threats in Puglia: extensive agricultural system and anthropogenic pressure caused by tourism.

This checklist is intended to be a starting point for new research, opening the way to further investigation. There are many unpublished records, some areas remain unexplored, knowledge of the distribution of Apulian butterflies still remains incomplete. For example, ecological requirements of species present on both sides of the Adriatic Sea, such as *Melanargia russiae, Melitaea trivia* and *Charaxes jasius* require elucidation.

The updated checklist has increased the known number of species, but there is a strong possibility that new species will be added in the future. We hope that this contribution will encourage more people and public decision-makers to increase the efforts to better understand the distribution and the population status of butterflies in Puglia and South Italy.

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Appendix 1
Checklist of butterflies of Puglia with their updated presence in the localities surveyed. Available at http://www.phegea.org/Phegea/Appendices/Phegea48-4_S1.pdf

Appendix 2
Review of published records. Available at http://www.phegea.org/Phegea/Appendices/Phegea48-4_S2.pdf

The hidden wing pattern in European species of the genus *Colias* (Lepidoptera: Pieridae)

Otakar Kudrna

Abstract. Wing pattern is known to play an important role in the life of butterflies. Insect eyes perceive a different light spectrum than human eyes. Butterfly eyes perceive short wavelengths invisible to the human eye, particularly the ultra violet rays in the range of 365 nm. The hidden wing pattern is characteristic of pale coloured butterflies, particularly in the family Pieridae, especially in the genera *Colias* Fabricius, 1807 and *Gonepteryx* Leach, 1815. This short paper shows the visible and hidden wind patterns of the European species of the genus *Colias* and give an impulse to reviewing the hidden wing pattern at least in European species of Pieridae.

Samenvatting. Het is bekend dat het vleugelpatroon een belangrijke rol speelt in het leven van vlinders. Insectenogen nemen een ander lichtspectrum waar dan menselijke ogen. Vlinderogen nemen korte golflengten waar die onzichtbaar zijn voor menselijke ogen, met name de ultraviolette stralen in het bereik van 365 nm. Het verborgen vleugelpatroon is kenmerkend voor bleekgekleurde vlinders, vooral in de familie Pieridae, meer bepaald in de geslachten: *Colias* Fabricius, 1807 en *Gonepteryx* Leach, 1815. Dit korte document is om in ware kleur het verborgen vleugelpatroon van de Europese soorten van het geslacht *Colias* te tonen en een impuls te geven om het verborgen vleugelpatroon te herbestuderen, in ieder geval voor de Europese soorten van Pieridae.

Résumé. Le motif des ailes est connu pour jouer un rôle important dans la vie des papillons. L'œil des insectes perçoit un spectre lumineux différent de celui de l'œil humain. L'oeil des papillons perçoit de courtes longueurs d'onde invisibles à l'oeil humain, en particulier les rayons ultraviolets de l'ordre de 365 nm. Le motif caché des ailes est caractéristique des papillons de couleur pâle, en particulier dans la famille des Pieridae, et spécialement dans les genres *Colias* Fabricius, 1807 et *Gonepteryx* Leach, 1815. Le but de ce court article est d'illustrer, en couleurs visibles, le motif caché des ailes des espèces européennes du genre *Colias* et de donner une impulsion à la révision de ce motif, au moins chez les espèces de Pieridae d'Europe.

Key words: *Colias* – Hidden wing pattern – Europe.

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Wing pattern is known to play an important role in the life of butterflies and its pretty diversifications are illustrated in "butterfly books". Wing pattern makes butterflies the most beautiful objects created by nature admired even by laymen. Wing pattern has been extensively studied by B. N. Schwanwitsch (1889–1957) who published 13 fundamental papers on the subject in the years 1924–1956 (see References). The purpose of this short paper is to compare the visible and hidden wing pattern of European species of the genus *Colias* Fabricius, 1807.

Insect eyes perceive a different light spectrum than human eyes. Butterfly eyes perceive short wave lengths invisible to human eyes, particularly the ultra violet rays in the range of 365 nm. Butterflies can thus distinguish objects perceived as of the same colour by human eyes, for instance white, different according to their absorption or reflection short wave UV light. This applies both to other butterflies and to flowers. Mazokhin-Porshnyakov (1969) discovered that certain butterfly species differ by the way their wings reflect or absorb UV light although their colour appears identical to human eye. He described this phenomenon and named it the hidden wing pattern.

The hidden wing pattern is characteristic of pale coloured butterflies, particularly in the family Pieridae, especially in the genera: *Colias* Fabricius, 1807 and *Gonepteryx* Leach, 1815. The hidden wing patter is found also in the genus *Pieris*, but its specific presence and variation are not adequately known. Shreve *et al.* (2009) confused the hidden wing patter with the light reflected by silver and pearl coloured components of the wing pattern such as is found e.g. in the genus *Argynnis* Fabricius, 1807 (Kudrna 2013).

Settele *at al.* (2009) were right to invite a group of authors to compile a chapter on wing pattern in their study of ecology of butterflies in Europe (Shreeve *at al.* 2009). Surprisingly both the editors of the book and the authors of the chapter were not aware of the fundamental work of their predecessor B.N. Schwanwitsch and mistook the hidden wing pattern produced by UV light (Mazokhin-Porshnyakov 1969) with a simple reflection of light produced by elements of metallic colours on butterfly wings; none of their photos shows hidden wing pattern. Regrettably they made no reference to the methods utilized.

The authors of the two recently published standard reference works on the genus *Colias* Fabricius, 1807, (Grieshuber *et al*. 2012, Grieshuber 2014) overlooked the external anatomy of genitalia and failed to describe perhaps the most interesting feature of the genus: the hidden wing pattern. They were unaware of the existence of the hidden wing pattern and of any papers on the subject (e.g. Ferris 1972, Kudrna 1992). The purpose of this short paper is to illustrate in true colour the hidden wing pattern of the European species of the genus *Colias* and give an impulse to reviewing the hidden wing pattern at least in European species of Pieridae.

Using the hidden wing pattern as a criterion the species of the genus *Colias* can be split into two groups:

(1) The first group contains species the dorsal wing pattern of which absorbs UV rays. The following European species belong to this group:

Colias alfacariensis Ribbe, 1905 (Figs 1, 2)
Colias erate (Esper, [1803]) (Figs 11, 12)
Colias hyale (Linnaeus, 1758) (Figs 15, 16)
Colias palaeno (Linnaeus, 1760) (Figs 19, 20)

Colias phicomone (Esper, [1780]) (Figs 21, 22)
Colias tyche Boeber, 1812 (Figs 23, 24)

The upper wing surface of these species is yellow, white or greenish, never orange.

(2) The second group contains species in which the dorsal pattern of wings reflects (to various extent and intensity) UV rays:

Colias aurorina (Herrich-Schäffer, [1850]) (Figs 3, 4)
Colias balcanica Rebel, 1903 (Figs 5, 6)
Colias chrysotheme (Esper, [1781]) (Figs 7, 8)
Colias crocea (Geoffroy, 1785) (Figs 9, 10)
Colias hecla Lefebvre, 1836 (Figs 13, 14)
Colias myrmidone (Esper, [1781]) (Figs 17, 18)

In these species the upper wing surface is orange or orange-yellow except the case of rare yellow males of *C. crocea* which appear similar to *C. erate* but reflect UV rays.

UV photographs can be produced using various techniques (e.g. Bowden & Kay 1979, Ferris 1972, Kudrna 1992). The present photos were taken by SLR Contax 139 with Planar 50 mm, f. 1.7 standard lens on Agfacolor 200 ASA colour slide film using a Paffrath & Kemper ring flash as UV light source and a Hoya U360 filter (= Schott U1 glass) to eliminate visible light.

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Fig. 1. *Colias alfacariensis* RIBBE, 1905 – Germany: N.W. Bavaria (conventional lighting).

Fig. 2. *Colias alfacariensis* RIBBE, 1905 – Germany: N.W. Bavaria (UV lighting).

Fig. 3. *Colias aurorina* (HERRICH-SCHÄFFER, [1850]) – Greece (conventional lighting).

Fig. 4. *Colias aurorina* (HERRICH-SCHÄFFER, [1850]) – Greece (UV lighting).

Fig. 5. *Colias balcanica* REBEL, 1903 – Macedonia (conventional lighting).

Fig. 6. *Colias balcanica* REBEL, 1903 – Macedonia (UV lighting).

Fig. 7. *Colias chrysotheme* (ESPER, [1781]) – Hungary (conventional lighting).

Fig. 8. *Colias chrysotheme* (Esper, [1781]) – Hungary (UV lighting).

Fig. 9. *Colias crocea* (GEOFFROY, 1785) – N. Italy (conventional lighting).

Fig. 10. *Colias crocea* (GEOFFROY, 1785) – N. Italy (UV lighting).

Fig. 11. *Colias erate* (ESPER, [1803]) – Ukraine (conventional lighting).

Fig. 12. *Colias erate* (ESPER, [1803]) – Ukraine (UV lighting).

Fig. 13. *Colias hecla* LEFEBVRE, 1836 – N. Sweden: Lapland (conventional lighting).

Fig. 14. *Colias hecla* LEFEBVRE, 1836 – N. Sweden: Lapland (UV lighting).

Fig. 15. *Colias hyale* (Linnaeus, 1758) – Germany: N.W. Bavaria (conventional lighting).

Fig. 16. *Colias hyale* (Linnaeus, 1758) – Germany: N.W. Bavaria (UV lighting).

Fig. 17. *Colias myrmidone* (ESPER, [1781]) – Czechia: S.E. Moravia (conventional lighting).

Fig. 18. *Colias myrmidone* (ESPER, [1781]) – Czechia: S.E. Moravia (UV lighting).

Fig. 19. *Colias palaeno* (LINNAEUS, 1760) – Czechia: S.W. Bohemia (conventional lighting).

Fig. 20. *Colias palaeno* (LINNAEUS, 1760) – Czechia: S.W. Bohemia (UV lighting).

Fig. 21. *Colias phicomone* (ESPER, [1780]) – Switzerland (conventional lighting).

Fig. 22. *Colias phicomone* (ESPER, [1780]) – Switzerland (UV lighting).

Fig. 23. *Colias tyche* Boeber, 1812 – N. Sweden: Lapland (conventional lighting).

Fig. 24. *Colias tyche* Boeber, 1812 – N. Sweden: Lapland (UV lighting).

Opilo mollis (Coleoptera: Cleridae) in de Benelux

Willy Troukens & Alain Drumont

Samenvatting. Naar aanleiding van twee vangsten van *Opilo mollis* (Linnaeus, 1758) in 2017 en 2019 te Oudergem (Brussels Hoofdstedelijk Gewest, België) besloot de eerste auteur een studie te maken over de verspreiding van deze soort in de Benelux. Deze kever leeft onder schors van dode takken en stammen van loofhout waar hij jaagt op schorskevers. Hij is overal zeldzaam. De verspreidingskaart toont aan dat hij in sommige streken volledig ontbreekt.

Abstract. Following the capture of two specimens of *Opilo mollis* (Linnaeus, 1758) in 2017 and 2019 at Oudergem (Brussels-Capital Region, Belgium), the first author decided to gather all information about the presence of this species in the Benelux countries. This beetle lives under the bark of decaying stems and branches of deciduous trees which are colonized by bark beetles. Everywhere it is very rare. The distribution map shows that it is unknown in some regions of Benelux.

Résumé. A la suite de deux captures d'*Opilo mollis* (Linnaeus, 1758) en 2017 et 2019 à Auderghem (Région de Bruxelles-Capitale, Belgique), le premier auteur a décidé de commencer une étude concernant la répartition de cette espèce au sein du Bénélux. Ce coléoptère vit sous l'écorce des troncs et des branches morts des arbres feuillus où il pourchasse les coléoptères xylophages. Il est partout rare et la carte de répartition démontre qu'il est complètement absent de certaines régions des trois pays composant le Bénélux.

Key words: Coleoptera – Cleridae – *Opilo mollis* – Faunistics – Benelux.

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Inleiding

In 2017 werd in de Botanische Tuin Jean Massart te Oudergem (Brussels Hoofdstedelijk Gewest - BHG) een exemplaar aangetroffen van de zachtharige mierkever, *Opilo mollis* (Linnaeus, 1758) (Coleoptera: Cleridae) (leg. Alain Drumont & Hugo Raemdonck). De kever werd gevonden in een raamval van het type Crosstrap (Econex, Muria, Spanje) met paddenstoelen als lokmiddel, vooral oesterzwammen (*Pleurotus* sp.), vermengd met champignons (*Agaricus bisporus*) (Fig. 1).

Fig. 1. Raamval, type Crosstrap, voorzien van paddenstoelen als aas (Oudergem, Botanische Tuin J. Massart, 2017). © Alain Drumont.

Deze paddenstoelen werd in nylon kousen gestopt en bevestigd bovenaan de val. Deze val werd opgesteld aan een bosrand boven een stapel takken van loofhout (Fig. 2). De paddenstoelen werden elke 3 à 4 weken vervangen en het was op zo een moment dat het eerste exemplaar werd ontdekt (24.v.–1.vi.2017, in coll. KBIN).

In 2019 werd een tweede exemplaar aangetroffen in dezelfde omstandigheden (Fig. 3). Deze keer was de opvangpot verbonden met een korf die voor de helft gevuld was met oesterzwammen en champignons. Later in het seizoen werd de korf verder aangevuld met paddenstoelen die ter plaatse werden verzameld (Fig. 4). De val was omringd door 5 raamvallen van het type Crosstrap. Dit exemplaar van *O. mollis* werd ontdekt tijdens een controle na een periode die duurde van 6 tot 18 juni 2019 (in coll. Hugo Raemdonck).

Het gaat hier om de eerste meldingen van deze mierkever in het Brussels Hoofdstedelijk Gewest. De ontdekking van deze twee exemplaren heeft ons ertoe aangezet om een onderzoek te starten over hun biologie en hun verspreiding in de Benelux.

De familie Cleridae (Mierkevers)

De Benelux telt 16 soorten Cleridae (Drumont *et. al.* 2011; Vorst 2010: 119). Hiervan moeten 2 species als adventief beschouwd worden, nl. *Clerus mutillarius* (Fabricius, 1775) (Troukens 1999: 29–31) en *Tarsostenus carus* (Newman, 1840) (Troukens 2018: 199–120). De vertegenwoordigers van deze familie zijn middelgrote kevers, vaak met bonte kleuren of met een donkere metaalglans. Hun lichaam is behaard. De sprieten zijn 11-ledig, soms gezaagd, maar meestal draadvormig met een 3-ledige eindknots. De tarsen zijn 5-ledig – schijnbaar 4-ledig – waarvan de eerste 3 hartvormig verbreed zijn (Lyneborg 1977: 112). Zowel de larven als de imago's leven als carnivoren van andere insecten. Sommige imago's bezoeken ook bloemen en vreten stuifmeel. Een

Fig. 2. Opgestapeld hout met raamval (Oudergem, Botanische Tuin J. Massart, 2017).© Alain Drumont.

Fig. 3. Korf met paddenstoelen, omringd door 5 raamvallen, type Crosstrap (Oudergem, Botanische Tuin J. Massart, 2019). © Alain Drumont.

geval apart vormen de bijenwolf, *Trichodes apiarius* (Linnaeus, 1758), wiens larven als parasiet leven in bijennesten en de *Necrobia*-soorten die zich voeden met droge of rottende dierlijke stoffen (Harde *et. al.* 1982: 154). Tegenwoordig schat men het aantal Cleridae-soorten wereldwijd op meer dan 4000 (Willner 2013: 164–167).

Beschrijving van *O. mollis*

(Fig. 5)

O. mollis is een slanke kever van 8 à 13 mm. Zijn lichaam is licht- tot donkerbruin, bedekt met lange, zijdeachtige haren (du Chatenet 2000: 45). Sprieten geelbruin, vrij lang, met 3 verdikte eindleden (Kuhnt 1911: 465). Poten geelbruin; de bovenhelft van de dijen zwartbruin. Dekschilden breder in de achterste helft. Elk dekschild vanaf de schouder tot de naad met een schuine roodbruine vlek, maar onderbroken door de 3de tussenruimte; een brede, gele dwarsband achter het midden die niet reikt tot aan de naad; en tenslotte een gele apicale vlek (Lohse 1979: 90–91). De dekschilden zijn voorzien van stippelstrepen die achter het midden geleidelijk verdwijnen; de beide zijstrepen zijn onregelmatig bestippeld; de 7de tussenruimte fijn, kielvormig verheven (Keer 1930: 454).

O. mollis kan bij een vluchtige waarneming verwisseld worden met de verwante *O. domesticus* (Sturm, 1837). Deze laatste is bleker. Bovendien zijn de stippelstrepen volledig en ontbreekt het kieltje in de 7de tussenruimte (Lohse 1979: 90–91).

Fig. 4. Binnenzicht van de korf met ter plaatse verzamelde paddenstoelen (Oudergem, Botanische Tuin J. Massart, 2019).© Alain Drumont.

Levenswijze

O. mollis is te vinden in bosgebieden en parken met oude loof- en naaldbomen (Albouy & Richard 2019: 212). Zowel de larven als de imago's leven achter schors of in het hout van dode takken en stammen. Ze maken jacht op andere insecten zoals *Pissodes*-larven (Curculionidae) (Keer 1930: 454) en klopkevers (Ernobinae: Anobiidae) (Albouy & Richard 2019: 212).

Uit de 79 vanggegevens waarover wij konden beschikken blijkt dat de meeste exemplaren werden ontdekt op stammen van dode loofbomen, nl. op knotwilg (*Salix alba*), beuk (*Fagus*), esdoorn (*Acer*), eik (*Quercus*), walnoot (*Juglans regia*), linde (*Tilia*) en hazelaar (*Corylus*). Keer (1930: 454) noemt bovendien ook nog iep (*Ulmus*) en klimop (*Hedera helix*). *O. mollis* voelt zich ook thuis in oude boomgaarden. In 2017 verzamelde Luc Crevecoeur 8 exemplaren in hoogstamboomgaarden op 4 verschillende lokaliteiten in Limburg. De kever wordt ook wel eens ontdekt op plaatsen waar men hem niet zou verwachten. Begin april 2005 – na een lange winter – inspecteerde de Franse imker Xavier Lair, voor het eerst zijn bijenkasten te Saint-Martin-de-Cenilly (Normandië). In één van de kasten zaten tussen het dak en het framedeksel, behalve enkele mieren (*Lasius*) en oorwormen (Dermaptera), ook een soort mierkevertje. Het beestje bleef daar rustig zitten en zat schijnbaar op iets te wachten. De imker dacht eerst aan de beruchte bijenwolf, *T. apiarius*, en bezorgde het insect ter determinatie aan zijn vriend-entomoloog Alain Livory. Het bleek geen bijenwolf te zijn maar wel de plaatselijk zeer zeldzame *O. mollis*. Men kan zich afvragen of zijn aanwezigheid op de bijenkast wel echt toevallig was. Of zou hij zich bij gelegenheid ook wel eens laten verleiden door het bijenbroed (Lair 2005: 44)?

De imago's van *O. mollis* zijn het hele jaar aan te treffen, vooral van maart tot augustus, maar met een duidelijke piek in juni en juli. Om ze te vangen kan men het best gebruik maken van het klopscherm. Dat de kevers ook 's nachts actief zijn blijkt uit een lichtvangst op 3.vi.2017 te Lier (AN) (leg. Wim Veraghtert / Waarnemingen.be) en op 21.viii.2019 een vangst op smeer te Vossem (VB) (leg. Ralph. V./Waarnemingen.be).

Fig. 5. *Opilo mollis* (Linnaeus, 1758). Finnevaux (NA), 2.vi.2005. © Gérard Minet.

Verspreiding

(Fig. 6)

O. mollis bewoont het grootste deel van Europa maar ontbreekt in het noorden en op het Iberisch schiereiland (du Chatenet 2000: 45). Hij is overal zeldzaam.

In Nederland wordt deze soort weinig opgemerkt. Hij is nu bekend van 15 vindplaatsen, vooral in Zuid-Limburg. Elders gaat het om occasionele of eenmalige vondsten. Sinds de eeuwwisseling zijn slechts 3 vangsten gemeld, nl. te Schinnen (LI), 6.xi.2002 1 ex.; Eijsden (LI), 18.x.2002 1 ex. op dood berkenhout (*Carpinus*) (Dré Teunissen, pers. med.) en te Well-Leukermeer (LI), 8.xii.2013 1 ex. (leg. Twan Martens/Waarneming.nl).

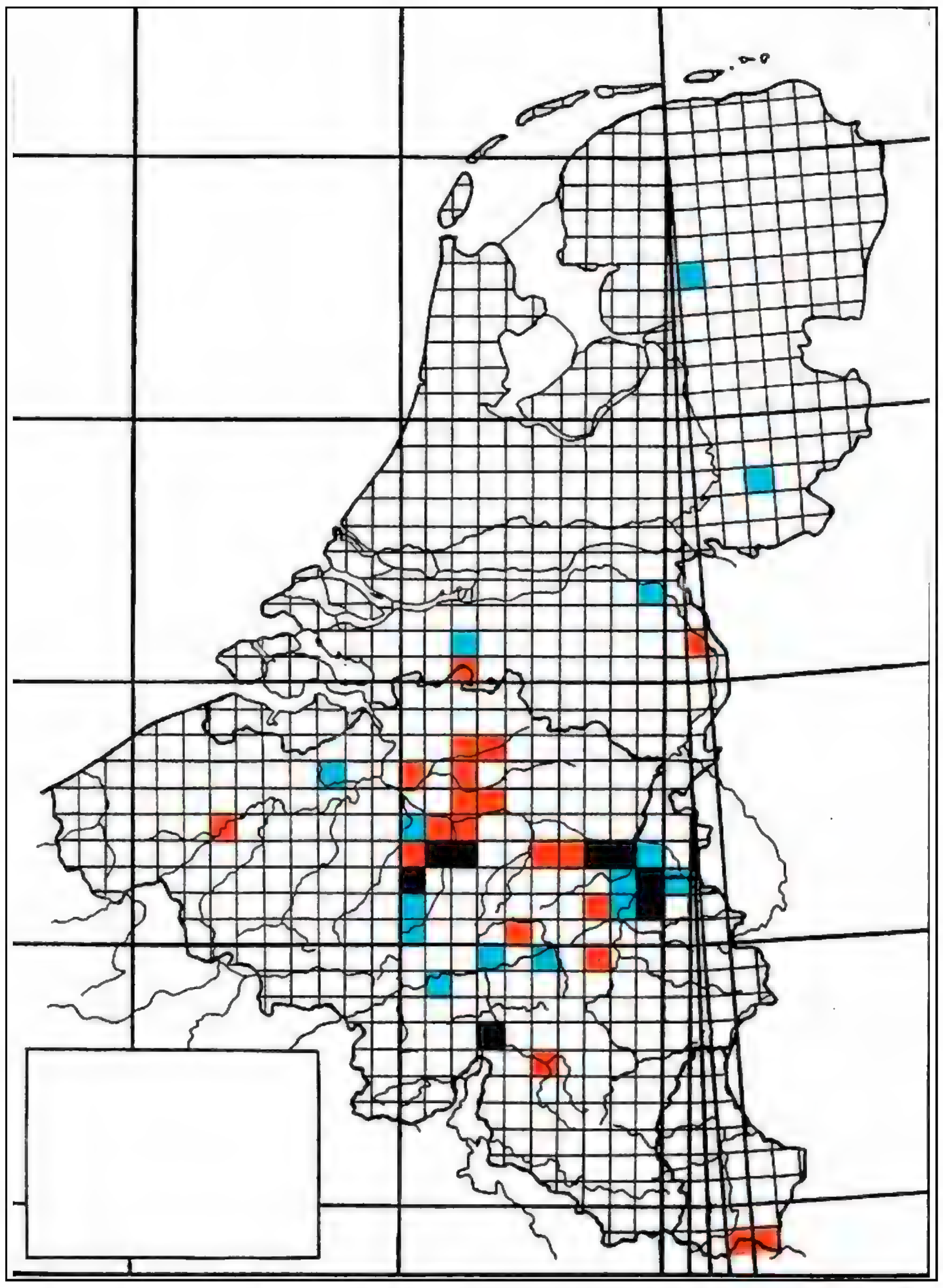

Fig. 6. Vindplaatsen van *Opilo mollis* (Linnaeus, 1758) in de Benelux. Kleurverklaring: blauw = tot en met 2000; rood = na 2000; zwart: zowel tot 2000 als na 2000.

In België is *O. mollis* waarschijnlijk altijd inheems geweest. Het oudste exemplaar in de collecties van het KBIN te Brussel werd gevangen op 15.v.1898 te Genval (BW) door de bekende entomoloog Félix Guilleaume. Sindsdien wordt de kever in ons land regelmatig gesignaleerd maar in bepaalde streken voelt hij zich blijkbaar minder thuis. Grosso modo komt hij alleen voor ten oosten van de lijn Antwerpen-Brussel-Charleroi (zie fig. 6). Toch zijn uit Oost-Vlaanderen ook twee vangsten bekend maar deze moeten beschouwd worden als adventieven. Het eerste werd op 28.viii.1987 gevonden te Hamme (OV) onder schors van ingevoerd eikenhout uit Frankrijk (leg. René Pletinck); het tweede werd op 15.iii.2019 binnenshuis ontdekt te Astene (OV) (leg. Jeroen Van Wichelen/Waarnemingen.be).

Ook in het Groothertogdom Luxemburg is *O. mollis* een zeldzaamheid. Wij kennen slechts twee recente vangsten, nl. te Frisange/Aspelt, 7.vi.2007 1 ex., geklopt uit een dode tak van een linde (leg. Raoul Gerend) en te Schengen, 5 ex., verzameld in de jaren 2008-2009 in het bosgebied "Grouf" (Köhler 2013: 51-107).

Besluit

Uit deze studie blijkt dat *O. mollis* te vinden is op dood hout in bossen, parken en hoogstamboomgaarden. In de datagegevens is er telkens sprake van loofhout, nooit van naaldhout, dit in tegenstelling tot wat de meeste kevergidsen vermelden. Het kaartje toont in elk geval aan dat de soort ontbreekt in de 16.000 ha naaldbossen van Belgisch Limburg. Zou het kunnen dat *O. mollis* en *O. domesticus* soms met elkaar verward worden? Van *O. domesticus* weten wij dat hij vooral gevonden wordt in oude gebouwen met dakconstructies, gemaakt van naaldhout, waar hij jacht maakt op het klopkevertje, *Ernobius mollis* (Linnaeus, 1758). Hopelijk kunnen toekomstige vangsten hieromtrent wat meer klaarheid scheppen.

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Korte mededeling

Rups van Ligusterpijlstaart *Sphinx ligustri* (Lepidoptera: Sphingidae) op Sierstruik *Spiraea nipponica* (Rosaceae)

André Verboven

Tijdens werkzaamheden in mijn tuin in Heverlee, Vlaams-Brabant op 15 augustus 2020 ontdekte ik een volgroeide rups van Ligusterpijlstaart *Sphinx ligustri* Linnaeus, 1758 op een sierstruik, *Spiraea nipponica* Maxim.“June Bride”, afkomstig uit Japan en voor zover ik kon nagaan nog niet gemeld als voedselplant voor deze soort (Robinson *et al.* 2010). De rups leeft polyfaag op een aantal bomen en struiken, waaronder ook twee soorten uit het geslacht *Spiraea*: *S. chamaedryfolia* L. en *S. salicifolia* L..

Referentie

Robinson G. S., Ackery P. R., Kitching I. J., Beccaloni G. W. & Hernández L. M. 2010. HOSTS – A Database of the World's Lepidopteran Hostplants. Natural History Museum, London. http://www.nhm.ac.uk/hosts. (Geraadpleegd: 17 augustus 2020).

Book Reviews

Sinev S. Yu. (Ed.). 2019. Catalogue of the Lepidoptera of Russia. Second Edition.
21 × 30 cm (A4) 448 p. published by the Zoological Institute of the Russian Academy of Sciences, St. Petersburg.
ISBN 978-5-98092-068-5. Free downloadable online (7487 kb)
https://www.zin.ru/publications/books/Lepidoptera_Russia/Catalogue_of_the_Lepidoptera_of_Russia.pdf

This second, updated and verified edition of the *Catalogue of the Lepidoptera of Russia* (the first edition, published in 2008, is out of print and no longer available for sale, see Pemberley Natural History Books available at https://www.pemberleybooks.com/product/catalogue-of-the-lepidoptera-of-russia/21507/). The second edition will be warmly welcomed by almost everyone interested in Lepidoptera. It is a very encouraging fact for everybody that this Catalogue is downloadable for free.

Unlike other large zoogeographical regions, Russia, occupying almost 1/6 of the entire terrestrial area of the world, is rather well explored and studied for its Lepidoptera fauna. Historically, these studies were subsidized and targeted for specific groups of insects and were carried on for more than 200 years. There is no doubt that the general interest in entomology in Russia facilitated greatly to the taxonomic and faunistic knowledge as well as to the creation of one of the biggest Lepidoptera collections in the world. This Lepidoptera collection of ca. 5 million specimens is deposited in the Zoological Institute of RAS in St. Petersburg. The complex of buildings which includes the Biological Faculty of the University, the Zoological Research Institute, and the series of world-class museums (Zoological Museum, Hermitage Museum, Kunstkamera Museum and others) has made the small area on the Neva River a world-class site for science and art expertise, and also heritage. During the preparation of the Catalogue, exhaustive cross-checking and verification of material and literature, including obscure publications in languages other than Russian, were studied and consulted, and our Russian colleagues are warmly congratulated on the publication of this valuable source of reference. Though the catalogue is in Russian, it is easily consultable by any non-Russian speaker, since all the significant information is presented in an English summary and the species are arranged in tables. All lepidopteran species names are presented in their scientific binominal nomenclature, no vernacular names are given. The distribution records are presented in a tabular form, similar to the Catalogue of the Lepidoptera of Belgium by Willy De Prins (2016).

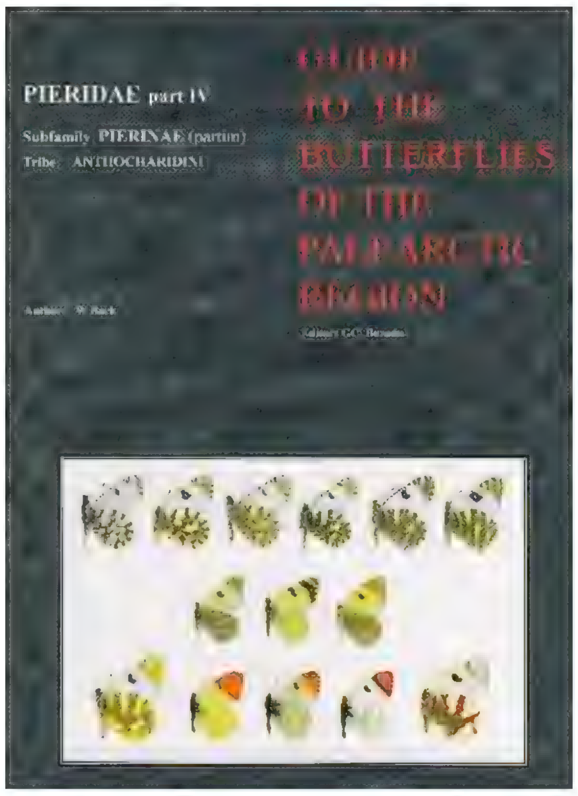
One can argue the generic assignments in some microlepidoptera families for example in Coleophoridae, but knowing the research history of Microlepidoptera in Russia, and the different views on taxonomy and classification taken by specialists throughout the World, the editor accepts the way the contributors present their classification. Anyway, the purpose of the Catalogue is to present the reliable species-group taxa information, and this is certainly done well, with the exemplary attention. The Catalogue presents the information on the distribution records in Russia of 9617 species (5617 Microlepidoptera and 4000 Macrolepidoptera species) assigned to 2251 genera (1039 in Microlepidoptera and 1212 in Macrolepidoptera). Results of recent molecular studies have shown that the division of micro- and macro- Lepidoptera does not have any phylogenetic basis, but for many members of the VVE, the size of a moth is still a convenient orientation point for photographing and recording activities. Despite the fact that catalogues are not taxonomic revisions, nevertheless almost all of them contain taxonomic and nomenclatural changes. While compiling any catalogue, the authors and contributors re-examine species concepts which have been accepted for many years and have never been re-examined. So, catalogues serve as reference points at a certain period of history for the consensual species or genus hypothesis at the time. The present catalogue introduces quite some nomenclatural changes in well-known Palaearctic Lepidoptera: nine new synonymies, seven new combinations, two new status and one new species re-verification. As one might expect, all these taxonomic changes are in the more primitive taxonomic groups of Lepidoptera: Incurvariidae, Gracillariidae, Cosmopterigidae, Alucitidae, Pyralidae, and Geometridae. Six species are mentioned for Russia for the first time: *Saridoscelis synodias* Meyrick, 1932 (Yponomeutidae); *Chrysoclista gabretica* Šumpich, 2012 (Parametriotidae); *Blastobasis pannonica* Šumpich & Škyva, 2011 and *Hypatopa montivaga* Moriuti, 1982 (Blastobasidae); *Eteobalea bernhardiella* (Kasy, 1973) (Cosmopterigidae); *Polopeustis arctiella* (Gibson, 1920) (Pyralidae).

The territory which is covered by this publication is huge: extending from Kaliningrad in the West to Sakhalin Island in the East. It is divided into forty biogeographical regions. In most cases the borders of these regions overlap with the borders of the administrative units, because the creation of the internal administrative units in Russia in most cases was based on geography, so the borders are along huge rivers or mountain ranges. The forty biogeographical units serve to present the biodiversity data as geography-defined information blocks. However, the well-established and broadly used historic names as Caucasus, Altai, Baikal, Kamchatka, Amur, Primorje, Kuril in this Catalogue are clearly defined.

Many members of the VVE take part in international expeditions or are active in cataloguing and recording the Palaearctic Lepidoptera fauna. So, this catalogue will be consulted very often for names and distribution records. The Open Access approach made it part of the international Lepidoptera cataloguing efforts. The publication of the second edition of the Catalogue of Russia took out huge areas of the Palaearctic region from the grey zone of knowledge and marked the distribution data of Lepidoptera as studied and verified. This book and the online pdf file will certainly serve as a reference for many lepidopterists and for many years to come. The community of lepidopterists thanks the editor and the contributors for their enormous and highly appreciated efforts. It is also a very nice result of a well-coordinated collaboration of several working-groups of taxonomists.

Jurate De Prins

Back W. 2020. Pieridae part IV. Subfamily Pierinae (partim), Tribe Anthocharidini. – In: Bozano G. C. (Ed.), ***Guide to the butterflies of the Palearctic Region*****.**
21 × 30 cm, 102 p., Omnes Artes, s.a.s., Via Torquato Tasso 22, I-24047 Treviglio, Bergamo, Italy, www.omnesartes.com, segretaria@omnesartes.com, paperback, 32,- EUR + portkosten, (ISBN 978-88-87989-24-3).



In dit vierde deel over de familie Pieridae in de reeks "Guide to the butterflies of the Palearctic Region" wordt het tribus Anthocharidini behandeld. In het Palaearctisch gebied omvat dit tribus de genera *Anthocharis, Zegris, Euchloe, Iberochloe en Elphinstonia*. Daarnaast komen er nog eens vijf genera voor in het Nearctisch gebied (*Eroessa, Cunizza, Hesperocharis, Mathania* en *Hebomoia*). Alle soorten van deze groep komen dus uitsluitend in de gematigde streken van het noordelijk halfrond voor. In dit boek worden 37 soorten behandeld. Veel van deze soorten beginnen hun vliegtijd vroeg in het voorjaar en het zijn dus echt aankondigers van de lente. Omdat ze al zo vroeg aan hun vliegtijd beginnen, hebben de meeste soorten tijd genoeg om een tweede, of zelfs een derde generatie voort te brengen in hetzelfde jaar.

De meeste soorten hebben een opvallend lichte grondkleur: wit, geel, groen en oranje. Er bestaat een belangrijke individuele en geografische variabiliteit en ook de verschillende generaties binnen één soort en in één jaar kunnen er behoorlijk verschillend uitzien. Ook bestaat er bij de meeste soorten in deze groep een uitgesproken seksueel dimorfisme. Dit is o.a. het best merkbaar bij de enige soort Anthocharidini die in België voorkomt: *Anthocharis cardamines* (Linnaeus, 1758) – het oranjetipje, waar het mannetje met zijn opvallende, oranje, costale vlek aantoont waarom de soort zo werd genoemd, terwijl het wijfje geen oranje bezit.

Dit boek wijkt een beetje af van de overige delen in de reeks omdat er opvallend meer aandacht aan ondersoorten wordt besteed. De redacteur, Gian Bozano, is zich daar terdege van bewust en hij schrijft dan ook in het voorwoord, en op enkele andere plaatsen in het boek, dat er van het algemene principe om "zwakke" ondersoorten als synoniemen te beschouwen wordt afgeweken omdat deze studie het levenswerk is van de auteur, Werner Back, wellicht een van de beste specialisten in deze groep dagvlinders. Met "zwakke" ondersoorten worden dan zulke groepen van populaties bedoeld die niet geografisch van elkaar gescheiden zijn en nog geregeld uitwisseling hebben van hun genetisch materiaal. Met eilandpopulaties is zo'n discussie uiteraard iets gemakkelijker dan met een haast ononderbroken voorkomen van b.v. *Anthocharis cardamines* vanaf Ierland en Portugal in het westen, doorheen heel Europa en Centraal-Azië, tot in Kamchatka en Chukotka (Russische Federatie) in het oosten. Zelfs op een detailkaartje van dezelfde soort met het voorkomen in Griekenland, Turkije, Iran, het Nabije-Oosten en het Kaukasische gebied, wordt ongeveer evenveel gebied ingekleurd als overgangszone tussen twee ondersoorten als het gebied van de ondersoorten zelf. In het totaal onderscheidt de auteur 19 ondersoorten. Ongeveer hetzelfde verhaal speelt zich af bij de wijd verspreide *Euchloe ausonia* (Hübner, 1804) waarbij de auteur 14 ondersoorten onderscheidt.

De nomenclatuur loopt over het algemeen synchroon met die uit de recente checklist door Wiemers *et al*. (2018) met twee uitzonderingen. Door vooral moleculair onderzoek werd *Iberochloe* Back, Knebelsberger & Miller, 2008 afgescheiden van het genus *Euchloe* Hübner, 1919 en de soorten *E. charlonia* (Donzel, 1842), *E. penia* (Freyer, 1851) en *E. bazae* Fabiano, 1993 worden nu in het genus *Elphinstonia* Klots, 1930 ondergebracht, eveneens gestuurd door vooral moleculaire argumenten.

Zoals het de gewoonte is in deze reeks boeken, is ook dit deel uitzonderlijk rijk geïllustreerd, vooral met kleurenfoto's van geprepareerde vlinders waarbij telkens van hetzelfde exemplaar de boven- en onderkant van één vleugelpaar worden afgebeeld. Voor elke soort wordt ook een verspreidingskaartje getoond. Hierbij valt op dat, in tegenstelling tot de eerder vermelde wijd verspreide soorten er ook enkele zeer lokaal voorkomen, o.a. *Iberochloe pechi* (Staudinger, 1885) in Noordoost-Algerije of *Euchloe simplonia* (Freyer, 1829) in Noord-Spanje en de westelijke Alpen, met als "toppers" *Euchloe hesperidum* Rothschild, 1913 alleen op Fuerteventura, *Euchloe eversi* Stamm, 1963 alleen op Tenerife en *Euchloe grancanariensis* Acosta, 2008 alleen op Gran Canaria.

Naast het grote aantal foto's van vlinders en de verspreidingskaartjes, bevat het boek ook foto's van mannelijke genitaalpreparaten van alle soorten en vele ondersoorten, en van rupsen en poppen. Met enkele lijnfiguren wordt aangetoond dat men in deze groep niet teveel waarde moet hechten aan de vleugeladering en dat die niet kan gebruikt worden voor taxonomische doeleinden binnen het tribus. Verder worden in dit deel, in tegenstelling tot in de vorige delen, enkele "neighbour joining trees" afgebeeld, o.a. voor de genera *Anthocharis*, *Euchloe* en *Zegris*.

Het boek eindigt met een literatuurlijst en een alfabetische index en is zeer keurig uitgegeven, gedrukt op stevig kwaliteitspapier. Het mag niet ontbreken in de bibliotheek van iemand dit zich aan dagvlinders interesseert.

Willy De Prins

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New records and an updated checklist of the butterfly fauna (Lepidoptera: Papilionoidea) of Puglia, south-eastern Italy

Giuseppe Cagnetta, Rocco Labadessa, Enrico Altini, Daniela Clemente & Alessio Vovlas

Supplementary table 1. Checklist of the butterflies of Puglia with their updated presence in the localities surveyed.

Tavoliere delle Puglie	**Subappennino Dauno**	**Terra di Bari**	**Arco Jonico**
1. Torremaggiore	11. Occhito	23. Barletta	35. Laterza
2. Bosco Incoronata	12. San Marco la Catola	24. Giovinazzo	36. Gioia del Colle
3. Lucera	13. Faeto	25. Lama Balice	37. Crispiano
4. Zapponeta	14. Biccari	26. Bari	38. Castellaneta
Gargano	15. Bovino	27. Conversano	39. Pinete dell'Arco jonico
5. Tremiti islands	16. Accadia	28. Monopoli	**Salento**
6. Lesina	**Alta Murgia**	**Valle d'Itria**	40. Torre Canne
7. Foresta Umbra	17. Locone	29. Alberobello	41. Torre Guaceto
8. S. Marco in Lamis	18. Corato	30. Locorotondo	42. S. Cataldo
9. Mattinata	19. Ruvo di Puglia	31. Cisternino	43. Otranto
10. Monte S. Angelo	20.Cassano delle Murge	32. Noci	44. Pulsano
	21. Santeramo in colle	33. Pianelle	
	22. Gravina	34. Ostuni	

Family HESPERIIDAE	
1. *Carcharodus alceae* (Esper, 1780)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
2. *Carcharodus baeticus* (Rambur, 1839)	18, 19, 20
3. *Carcharodus floccifera* (Zeller, 1847)	8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 32, 33, 36
4. *Erynnis tages* (Linnaeus, 1758)	7, 11, 12, 13, 14
5. *Gegenes nostrodamus* (Fabricius, 1793)	15, 17, 20, 21, 22, 25, 41
6. *Gegenes pumilio* (Hoffmannsegg, 1804)	1, 21, 23, 25, 27, 40, 42
7. *Hesperia comma* (Linnaeus, 1758)	
8. *Muschampia proto* (Ochsenheimer, 1808)	14, 17, 18, 19, 20, 21, 22, 36, 40
9. *Ochlodes sylvanus* (Esper, 1777)	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 29, 30, 32, 33
10. *Pyrgus armoricanus* (Oberthür, 1910)	8, 14, 22
11. *Pyrgus carthami* (Hübner, 1813)	
12. *Pyrgus malvoides* (Elwes & Edwards, 1897)	7, 8, 9, 10, 14, 17, 18, 19, 20, 21, 22, 29, 32, 36
13. *Pyrgus onopordi* (Rambur, 1839)	11, 12, 13, 14, 20, 21
14. *Pyrgus sidae* (Esper, 1784)	7, 8, 10, 12, 14, 18, 19, 20, 21, 22, 32, 33
15. *Spialia sertorius* (Hoffmannsegg, 1804)	3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 27, 29, 30, 32, 33, 34, 35, 36, 37, 38, 44
16. *Thymelicus acteon* (Rottemburg, 1775)	2, 3, 6, 7, 8, 9, 10, 17, 18, 19, 20, 22, 25, 27, 31, 33, 36, 38, 40, 41, 42
17. *Thymelicus lineola* (Ochsenheimer, 1808)	1, 13, 14, 18, 19, 21, 22, 33, 36, 40, 41
18. *Thymelicus sylvestris* (Poda, 1761)	1, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 29, 30, 32, 33, 34, 35, 36, 37

Family PAPILIONIDAE	
19. *Iphiclides podalirius* (Linnaeus, 1758)	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
20. *Papilio machaon* (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
21. *Zerynthia cassandra* (Geyer, 1828)	7, 8, 9, 14, 18, 20, 21, 22, 26, 27, 28, 29, 30, 31, 32, 33, 34, 36, 37, 40

Family PIERIDAE	
22. *Anthocharis cardamines* (Linnaeus, 1758)	2, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40
23. *Aporia crataegi* (Linnaeus, 1758)	2, 7, 8, 9, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 29, 30, 32, 33, 35, 36, 37
24. *Colias alfacariensis* (Ribbe, 1905)	7, 8, 9, 10, 18, 19, 20, 21, 22, 27, 32, 36, 40
25. *Colias croceus* (Geoffroy, 1785)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
26. *Euchloe ausonia* (Hübner, 1804)	2, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 31, 32, 33, 36, 40, 44
27. *Gonepteryx cleopatra* (Linnaeus, 1767)	3, 4, 5, 6, 7, 8, 9, 10, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
28. *Gonepteryx rhamni* (Linnaeus, 1758)	1, 7, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 32, 33, 40
29. *Leptidea sinapis* (Linnaeus, 1758)	7, 9, 11, 12, 13, 14, 15, 16, 17, 18, 22, 39, 42
30. *Pieris brassicae* (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
31. *Pieris ergane* (Geyer, 1828)	10
32. *Pieris mannii* (Mayer, 1851)	10
33. *Pieris napi* (Linnaeus, 1758)	1, 2, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 22, 27, 29, 30, 32, 33, 35, 36, 38, 40
34. *Pieris rapae* (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
35. *Pontia edusa* (Fabricius, 1777)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44

Family RIODINIDAE	
36. *Hamearis lucina* (Linnaeus, 1758)	14

Family LYCAENIDAE	
37. *Aricia agestis* (Denis & Schiffermüller, 1775)	1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 44
38. *Cacyreus marshalli* (Butler, 1898)	1, 2, 3, 4, 5, 6, 12, 14, 16, 18, 20, 21, 22, 23, 25, 27, 28, 29, 30, 31, 32, 34, 37, 38, 39, 40, 42, 43, 44
39. *Callophrys rubi (*Linnaeus, 1758)	6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 29, 30, 32, 33, 34, 35, 36, 37, 38, 40
40. *Celastrina argiolus* (Linnaeus, 1758)	2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
41. *Cupido alcetas* (Hoffmannsegg, 1804)	14, 15, 16, 22
42. *Cupido argiades* (Pallas, 1771)	15
43. *Cupido minimus* (Fuessly, 1775)	9, 11, 12, 13, 14, 15, 20, 21, 22, 29, 32, 33, 34, 35, 36, 38
44. *Cupido osiris* (Meigen, 1829)	12
45. *Cyaniris semiargus* (Rottemburg, 1775)	14, 29, 32, 33
46. *Eumedonia eumedon* (Esper, 1780)	
47. *Favonius quercus* (Linnaeus, 1758)	14, 21, 22, 29, 32, 33, 36
48. *Glaucopsyche alexis* (Poda, 1761)	7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 29, 31, 32, 33, 36, 38
49. *Iolana iolas* (Ochsenheimer, 1816)	16
50. *Lampides boeticus* (Linnaeus, 1767)	7, 12, 15, 17, 18, 19, 21, 22, 25, 26, 29, 30, 32, 36, 41
51. *Leptotes pirithous* (Linnaeus, 1767)	1, 3, 4, 6, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 33, 34, 35, 36, 38, 39, 40, 41, 42, 44
52. *Lycaena alciphron* (Rottemburg, 1775)	7
53. *Lycaena phlaeas* (Linnaeus, 1761)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
54. *Lycaena thersamon* (Esper, 1784)	11, 14, 15, 17, 18, 22, 22
55. *Lycaena tityrus* (Poda, 1761)	7, 11, 13, 14, 15, 16, 22
56. *Phengaris arion* (Linnaeus, 1758)	
57. *Plebejus argus* (Linnaeus, 1758)	10, 12, 13, 14
58. *Plebejus argyrognomon* (Bergsträsser, 1779)	
59. *Plebejus idas* (Linnaeus, 1761)	13
60. *Polyommatus amandus* (Schneider, 1792)	14
61. *Lysandra bellargus* (Rottemburg, 1775)	3, 7, 8, 9, 10, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 29, 30, 32, 33, 34, 35, 36, 37, 38, 40, 44
62. *Lysandra coridon* (Poda, 1761)	8, 10, 12, 18, 19, 21, 22, 31, 35
63. *Polyommatus daphnis* (Denis & Schiffermüller, 1775)	10, 12, 13
64. *Polyommatus dolus* (Hübner, 1823)	10
65. *Polyommatus dorylas* (Denis & Schiffermüller, 1775)	
66. *Polyommatus escheri* (Hübner, 1823)	12, 14

67. *Polyommatus icarus* (Rottemburg, 1775)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
68. *Polyommatus thersites* (Cantener, 1835)	7, 8, 9, 10, 12, 14, 15, 17, 18, 19, 20, 21, 22, 27, 41
69. *Pseudophilotes baton* (Bergsträsser, 1779)	8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 27, 32, 33, 35, 36, 40
70. *Satyrium acaciae* (Fabricius, 1787)	7, 8, 10, 14, 15, 20, 21, 22, 33
71. *Satyrium ilicis* (Esper, 1779)	2, 7, 12, 13, 14, 15, 18, 19, 20, 21, 22, 29, 30, 31, 32, 33, 34, 41
72. *Satyrium spini* (Denis & Schiffermüller, 1775)	8, 10, 14, 17, 18, 19, 20, 21, 22, 36
73. *Satyrium w-album* (Knoch, 1782)	13, 14, 20
74. *Thecla betulae* (Linnaeus, 1758)	

Family NYMPHALIDAE	
75. *Aglais io* (Linnaeus, 1758)	2, 7, 11, 12, 14, 15, 20, 22
76. *Aglais urticae* (Linnaeus, 1758)	14
77. *Argynnis adippe* (Denis & Schiffermüller, 1775)	7, 13, 14
78. *Speyeria aglaja* (Linnaeus, 1758)	10, 14
79. *Fabriciana niobe* (Linnaeus, 1758)	14
80. *Argynnis pandora* (Denis & Schiffermüller, 1775)	7, 14, 15, 18, 19, 20, 21, 22
81. *Argynnis paphia* (Linnaeus, 1758)	7, 8, 11, 12, 13, 14, 15, 16, 22
82. *Boloria euphrosyne* (Linnaeus, 1758)	14
83. *Brenthis daphne* (Bergsträsser, 1780)	7, 8, 12, 13, 14
84. *Brenthis hecate* (Denis & Schiffermüller, 1775)	19, 20, 22, 29, 32, 33
85. *Charaxes jasius* (Linnaeus, 1767)	27, 28, 29, 30, 33, 37, 40, 42, 44
86. *Chazara briseis* (Linnaeus, 1764)	
87. *Euphydryas aurinia* (Rottemburg, 1775)	11, 12, 14
88. *Issoria lathonia* (Linnaeus, 1758)	1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 26, 27, 29, 30, 32, 36, 38
89. *Libythea celtis* (Laicharting, 1782)	7, 20, 22, 36, 38
90. *Limenitis reducta* (Staudinger, 1901)	1, 2, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42
91. *Melitaea celadussa* Fruhstorfer, 1910	7, 8, 10, 12, 13, 14, 16, 29
92. *Melitaea cinxia* (Linnaeus, 1758)	7, 8, 12, 13, 14, 16, 18, 21, 22, 29, 32,
93. *Melitaea didyma* (Esper, 1778)	1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 25, 26, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43
94. *Melitaea ornata* Christoph, 1893	12
95. *Melitaea phoebe* (Denis & Schiffermüller, 1775)	1, 2, 3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 29, 32, 34, 35, 36, 37,
96. *Melitaea trivia* (Denis & Schiffermüller, 1775)	12, 18
97. *Nymphalis antiopa* (Linnaeus, 1758)	

98. *Nymphalis polychloros* (Linnaeus, 1758)	1, 2, 3, 6, 7, 8, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40
99. *Polygonia c-album* (Linnaeus, 1758)	2, 11, 12, 13, 14, 15, 20 , 22
100.*Polygonia egea* (Cramer, 1775)	6, 20 , 21, 22, 27, 29, 30, 31, 32, 33, 34, 35, 8, 39, 40, 44
101.*Vanessa atalanta* (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
102.*Vanessa cardui* (Linnaeus, 1758)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
103.*Brintesia circe* (Fabricius, 1775)	3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 29, 30, 32, 33, 34, 36, 37, 41
104.*Coenonympha arcania* (Linnaeus, 1760)	13, 14, 16
105.*Coenonympha pamphilus* (Linnaeus, 1758)	1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
106.*Danaus chrysippus* (Linnaeus, 1758)	4, 6, 23, 28, 39, 41, 42, 44
107.*Hipparchia fagi* (Scopoli, 1763)	7, 10, 11, 12, 14, 15, 22, 27
108.*Hipparchia semele* (Linnaeus, 1758)	7, 8, 9, 10, 13, 14, 16, 17, 18, 19, 20, 21, 22, 29, 30, 32, 33, 36
109.*Hipparchia statilinus* (Hufnagel, 1766)	6, 7, 8, 9, 10, 12, 14, 15, 17, 18, 19, 20, 21, 22, 25, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 44
110.*Hyponephele lupinus* (Costa, 1836)	8, 10, 19, 20, 27
111.*Hyponephele lycaon* (Kühn, 1774)	
112.*Lasiommata maera* (Linnaeus, 1758)	7, 8, 12, 14, 15, 17, 18, 21, 22, 27, 29, 30, 31, 32, 33, 34, 35, 36, 37
113.*Lasiommata megera* (Linnaeus, 1767)	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44
114.*Maniola jurtina* (Linnaeus, 1758)	1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 43, 44
115.*Melanargia arge* (Sulzer, 1776)	9, 10, 12, 14, 17, 18, 19, 20, 21, 22, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 43, 44
116.*Melanargia galathea* (Linnaeus, 1758)	2, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 27, 29, 30, 31, 32, 33, 34, 35, 36, 38, 39, 40
117.*Melanargia russiae* (Esper, 1783)	7, 8, 10, 12, 14, 17, 18, 19, 20, 21, 22, 33, 36, 38
118.*Pararge aegeria* (Linnaeus, 1758)	2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 42, 43
119.*Pyronia cecilia* (Vallantin, 1894)	3, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 25, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 40, 41, 44
120.*Pyronia tithonus* (Linnaeus, 1771)	11, 13, 14

New records and an updated checklist of the butterfly fauna (Lepidoptera: Papilionoidea) of Puglia, south-eastern Italy

Giuseppe Cagnetta, Rocco Labadessa, Enrico Altini, Daniela Clemente & Alessio Vovlas

Supplementary table 2. Review of published records.

Column I – Simes 1903
Column II – Cecconi 1908
Column III – Wimmers 1931
Column IV – De Togni 1948
Column V – Faggioli 1953
Column VI – Zangheri 1955
Column VII – Zangheri 1956
Column VIII – Zangheri 1960
Column IX – Parenzan 1975
Column X – Parenzan 1980
Column XI – Russo 2004
Column XII – Cicerale 2007
Column XIII: a = Verity 1940, b = Zilli 1988, c = Russo 2003, d = Parenzan *et al*. 2006, e = Cagnetta 2016)

Family HESPERIIDAE	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Carcharodus alceae (Esper, 1780)				+			+		+				
Carcharodus baeticus (Rambur, 1839)										+	+	+	
Carcharodus floccifera (Zeller, 1847)								+	+				
Erynnis tages (Linnaeus, 1758)											+	+	
Gegenes nostrodamus (Fabricius, 1793)										+		+	
Gegenes pumilio (Hoffmannsegg, 1804)										+			
Hesperia comma (Linnaeus, 1758)												+	
Muschampia proto (Ochsenheimer, 1808)							+	+	+			+	a
Ochlodes sylvanus (Esper, 1777)						+	+		+				
Pyrgus armoricanus (Oberthür, 1910)									+				
Pyrgus carthami (Hübner, 1813)													d
Pyrgus malvoides (Elwes & Edwards, 1897)				+		+	+		+				
Pyrgus onopordi (Rambur, 1839)							+		+				
Pyrgus sidae (Esper, 1784)				+			+	+	+			+	
Spialia sertorius (Hoffmannsegg, 1804)									+				
Thymelicus acteon (Rottemburg, 1775)								+	+				
Thymelicus lineola (Ochsenheimer, 1808)				+	+		+		+				
Thymelicus sylvestris (Poda, 1761)									+				

Family PAPILIONIDAE	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Iphiclides podalirius (Linnaeus, 1758)				+	+	+	+		+				
Papilio machaon (Linnaeus, 1758)			+	+			+		+				
Zerynthia cassandra (Geyer, 1828)				+			+		+			+	

Family PIERIDAE	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Anthocharis cardamines (Linnaeus, 1758)				+			+		+				
Aporia crataegi (Linnaeus, 1758)				+			+		+				
Colias alfacariensis (Ribbe, 1905)			+	+			+		+				
Colias croceus (Geoffroy, 1785)	+	+	+	+	+	+	+	+	+				
Euchloe ausonia (Hübner, 1804)				+			+		+				
Gonepteryx cleopatra (Linnaeus, 1767)		+	+	+			+		+				
Gonepteryx rhamni (Linnaeus, 1758)				+	+		+		+				
Leptidea sinapis (Linnaeus, 1758)			+	+		+	+		+				
Pieris brassicae (Linnaeus, 1758)	+	+		+		+			+				
Pieris ergane (Geyer, 1828)											+	+	
Pieris mannii (Mayer, 1851)				+		+	+			+			
Pieris napi (Linnaeus, 1758)				+					+				
Pieris rapae (Linnaeus, 1758)	+	+		+		+	+		+				
Pontia edusa (Fabricius, 1777)		+	+	+		+		+	+				

Family RIODINIDAE	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Hamearis lucina (Linnaeus, 1758)			+								+		

Family LYCAENIDAE	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Aricia agestis (Denis & Schiffermüller, 1775)		+	+	+		+	+	+	+				
Cacyreus marshalli (Butler, 1898)												+	c
Callophrys rubi (Linnaeus, 1758)			+	+			+		+			+	
Celastrina argiolus (Linnaeus, 1758)			+	+		+	+		+				
Cupido alcetas (Hoffmannsegg, 1804)											+	+	
Cupido argiades (Pallas, 1771)									+			+	
Cupido minimus (Fuessly, 1775)			+	+			+		+				
Cupido osiris (Meigen, 1829)											+		
Cyaniris semiargus (Rottemburg, 1775)			+						+		+	+	
Eumedonia eumedon (Esper, 1780)			+									+	
Favonius quercus (Linnaeus, 1758)									+				
Glaucopsyche alexis (Poda, 1761)			+	+			+		+				
Iolana iolas (Ochsenheimer, 1816)												+	
Lampides boeticus (Linnaeus, 1767)									+				
Leptotes pirithous (Linnaeus, 1767)									+				
Lycaena alciphron (Rottemburg, 1775)			+	+			+						
Lycaena phlaeas (Linnaeus, 1761)		+	+	+	+		+	+	+				
Lycaena thersamon (Esper, 1784)				+		+	+		+			+	
Lycaena tityrus (Poda, 1761)				+			+					+	

Family LYCAENIDAE	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Phengaris arion (Linnaeus, 1758)			+								+	+	
Plebejus argus (Linnaeus, 1758)			+									+	
Plebejus argyrognomon (Bergsträsser, 1779)				+			+						
Plebejus idas (Linnaeus, 1761)			+									+	
Polyommatus amandus (Schneider, 1792)			+									+	
*Lysandra bellargus (*Rottemburg, 1775)			+	+			+					+	
Lysandra coridon (Poda, 1761)								+	+				
Polyommatus daphnis (Denis & Schiffermüller, 1775)									+				
Polyommatus dolus (Hübner, 1823)			+								+	+	
Polyommatus dorylas (Denis & Schiffermüller, 1775)			+								+	+	
Polyommatus escheri (Hübner, 1823)			+									+	
Polyommatus icarus (Rottemburg, 1775)		+	+	+		+	+	+	+				
Polyommatus thersites (Cantener, 1835)			+						+				
Pseudophilotes baton (Bergsträsser, 1779)				+			+		+				
Satyrium acaciae (Fabricius, 1787)									+				
Satyrium ilicis (Esper, 1779)									+				
Satyrium spini (Denis & Schiffermüller, 1775)			+	+			+		+				
Satyrium w-album (Knoch, 1782)										+		+	
Thecla betulae (Linnaeus, 1758)												+	

Family NYMPHALIDAE	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Aglais io (Linnaeus, 1758)									+	+			
Aglais urticae (Linnaeus, 1758)	+												
Argynnis adippe (Denis & Schiffermüller, 1775)					+						+	+	
Speyeria aglaja (Linnaeus, 1758)											+	+	
Fabriciana niobe (Linnaeus, 1758)											+	+	
Argynnis pandora (Denis & Schiffermüller, 1775)			+	+	+		+		+				
Argynnis paphia (Linnaeus, 1758)				+	+	+	+						
Boloria euphrosyne (Linnaeus, 1758)				+			+				+		
Brenthis daphne (Bergsträsser, 1780)				+		+	+		+			+	
Brenthis hecate (Denis & Schiffermüller, 1775)									+	+			
Charaxes jasius (Linnaeus, 1767)									+				
Chazara briseis (Linnaeus, 1764)												+	
Euphydryas aurinia (Rottemburg, 1775)											+	+	
Issoria lathonia (Linnaeus, 1758)				+		+	+		+				
Libythea celtis (Laicharting, 1782)										+		+	
Limenitis reducta (Staudinger, 1901)			+	+		+	+		+				
Melitaea celadussa Fruhstorfer, 1910				+		+	+		+				

Family NYMPHALIDAE	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII
Melitaea cinxia (Linnaeus, 1758)				+		+	+		+				
Melitaea didyma (Esper, 1778)				+			+	+	+				
Melitaea ornata Christoph, 1893													e
Melitaea phoebe (Denis & Schiffermüller, 1775)				+			+		+				
Melitaea trivia (Denis & Schiffermüller, 1775)													e
Nymphalis antiopa (Linnaeus, 1758)										+			
Nymphalis polychloros (Linnaeus, 1758)		+					+		+				
Polygonia c-album (Linnaeus, 1758)													
Polygonia egea (Cramer, 1775)			+	+			+		+				
Vanessa atalanta (Linnaeus, 1758)	+					+	+		+				
Vanessa cardui (Linnaeus, 1758)		+				+	+	+	+				
Brintesia circe (Fabricius, 1775)									+				
Coenonympha arcania (Linnaeus, 1760)				+		+							
Coenonympha pamphilus (Linnaeus, 1758)			+	+		+		+	+				
Danaus chrysippus (Linnaeus, 1758)													b
Hipparchia fagi (Scopoli, 1763)				+		+							
Hipparchia semele (Linnaeus, 1758)			+	+		+			+				
Hipparchia statilinus (Hufnagel, 1766)				+	+	+		+	+				
Hyponephele lupinus (Costa, 1836)									+			+	
Hyponephele lycaon (Kühn, 1774)			+										
Lasiommata maera (Linnaeus, 1758)			+	+					+				
Lasiommata megera (Linnaeus, 1767)	+	+	+	+		+		+	+				
Maniola jurtina (Linnaeus, 1758)			+	+		+		+	+				
Melanargia arge (Sulzer, 1776)	+		+	+		+		+	+			+	
Melanargia galathea (Linnaeus, 1758)			+		+				+				
Melanargia russiae (Esper, 1783)			+	+					+				
Pararge aegeria (Linnaeus, 1758)				+		+			+				
Pyronia cecilia (Vallantin, 1894)		+		+		+		+	+				
Pyronia tithonus (Linnaeus, 1771)						+						+	